Notice of Determination

TO: ☒ Office of Planning and Research

For U.S. Mail:
P.O. Box 3044
Sacramento, CA 95812-3044

Street Address:
1400 Tenth Street
Sacramento, CA 95814

FROM: Department of Fish and Game
Central Region (4)
1234 East Shaw Avenue
Fresno, California 93710
Contact: Patricia Brantley
Phone: (209) 772-0703

LEAD AGENCY (if different from above):
Same as Above

SUBJECT: ***Filing of Notice of Determination in compliance with § 21108 of the Public Resources Code***

State Clearinghouse Number (if submitted to State Clearinghouse): 2010041098

Project Title: Merced River Ranch Floodplain Restoration Project

Project Location: Merced River Ranch, which is along the lower Merced River between river mile (RM) 50 and 51, east of Snelling and approximately one mile downstream of Crocker-Huffman Dam, in Merced County, CA

Project Description: The objectives of this restoration project are to rehabilitate and enhance channel, floodplain, and riparian ecosystem processes and critical habitats for juvenile and adult Chinook salmon and steelhead. The project consists of re-grading and rehabilitating ~6 acres of dredger tailings on the historic floodplain and ~5.5 acres of salmonid spawning habitat. Over a 5-year period, the floodplain will be graded and material from the floodplain will be screened to appropriate size classes and approximately 56,000 yd^3 of this material will be placed within the spawning channel.

This is to advise that DFG, acting as ☒ **the lead agency** / ☐ **a responsible agency** approved the above-described project on __/__/____ and has made the following determinations regarding the above described project:

1. The project ☐ **will** / ☒ **will not** have a significant effect on the environment. (This determination is limited to effects within DFG's jurisdiction when DFG acts as a responsible agency.)
2. ☐ **An environmental impact report** / ☒ **A negative declaration** was prepared for this project pursuant to CEQA.
3. Mitigation measures ☒ **were** / ☐ **were not** made a condition of DFG's approval of the project.
4. A mitigation reporting or monitoring plan ☒ **was** / ☐ **was not** adopted by DFG for this project.
5. A Statement of Overriding Considerations ☐ **was** / ☒ **was not** adopted by DFG for this project.
6. Findings ☐ **were** / ☒ **were not** made by DFG pursuant to Public Resources Code section 21081(a).
7. Compliance with the environmental filing fee requirement at Fish and Game Code section 711.4 (check one):
   - ☐ Payment is submitted with this notice.
   - ☐ A copy of a receipt showing prior payment is attached to this notice.
   - ☐ A copy of DFG's No Effect finding is attached to this notice.

☐ Responsible Agency statement: The final EIR or Negative Declaration prepared by the Lead Agency for this Project is available to the General Public at the office location listed above for the Lead Agency. DFG's administrative record of proceedings related to the incidental take permit is available to the pubic for review at DFG's Regional Office.

☒ Lead Agency statement: DFG, as Lead Agency, has made the final EIR with comments and responses and record of project approval, or the Negative Declaration, available to the General Public at the DFG office identified above.

Signature _____ *Date:* 6/24/10

Jeffrey R. Single, Ph.D., Regional Manager

Date Received for filing at OPR:

Mitigated Negative Declaration

PROJECT TITLE:	Merced River Ranch Floodplain Restoration Project
PROJECT LOCATION:	Stretch of the lower Merced River between river mile (RM) 50 and (RM) 51, east of Snelling and approximately 1 mile downstream of Crocker-Huffman Dam, in Merced County, California
PROJECT PROPONENT:	California Department of Fish and Game
LEAD AGENCY:	California Department of Fish and Game, Central Region, Fresno, California
SCH NUMBER:	2010041098

BRIEF DESCRIPTION: The objectives of this restoration project are to rehabilitate and enhance channel, floodplain, and riparian ecosystem processes and critical habitats for juvenile and adult Chinook salmon and steelhead. The project consists of re-grading and rehabilitating ~6 acres of dredger tailings on the historic floodplain and ~5.5 acres of salmonid spawning habitat. Over a 5-year period, the floodplain will be graded and material from the floodplain will be screened to appropriate size classes and approximately 56,000 yd^3 of this material will be placed within the spawning channel.

MITIGATION MEASURES: The proposed project has been modified to include mitigation measures to reduce potentially adverse impacts to less-than-significant levels. These mitigation measures are described in the attached Initial Study.

FINDING OF NO SIGNIFICANT EFFECT ON THE ENVIRONMENT: Based on this evaluation of possible significant effects of the proposed project, it has been determined that the proposed project would not have a significant adverse impact on the environment. Potentially significant adverse impacts would be mitigated to less-than-significant levels, as described in the Initial Study. Preparation of an Environmental Impact Report is not required.

Signed: _____ Date: 6/24/10

Name: Jeffrey R. Single, Ph.D. Title: Regional Manager

This Document has been Prepared in Accordance with the California Environmental Quality Act

Merced River Ranch Floodplain Restoration Project

Salmon Habitat Restoration on the Lower Merced River

Environmental Assessment/Initial Study

Prepared by:

California Department of Fish and Game
1234 E. Shaw Avenue
Fresno, CA 93710

and

U.S. Fish and Wildlife Service
Anadromous Fish Restoration Program
4001 N. Wilson Way
Stockton, CA 95205

April 2010

ERRATA: Merced River Ranch Floodplain Restoration Project Environmental Assessment/Initial Study – SCH No. 2010041098

The following revisions or additions are provided for clarification purposes and do not change the analysis and conclusions in the Draft Environmental Assessment/Initial Study:

1. The total amount of material to be placed in the spawning channel over a five-year phased construction period is 56,000 yd^3 is There is a correction at the bottom of page 15, stating that 53,000 yd^3 will be placed this should read 56,000 yd^3.

2. The Reclamation Board is now referred to as Central Valley Flood Protection

3. We have designed the project to avoid impacts to trees. There is a correction on page 16; Mitigation Measure #1 should be removed and placed in front of the next full paragraph describing "All equipment will be clean and use biodegradable lubricants and hydraulic fluids."

4. There is a correction on page 73. Box b and c should indicate significant unless mitigated. Mitigation measures #5 and #6 are included on page 29 but the boxes in the checklist were not check correctly. The document indicates project related construction activities will result in temporary adverse impacts to air quality. These effects are not expected to exceed California air quality standards or persist past the short construction time window and because the best available air quality control technologies, dust reduction measures, and Best Management Practices will be implemented during project construction, air quality impacts are considered less than significant. Over the long term the project would contribute to improving air quality, as floodplain function and encouraging native tree establishment and growth, are restored.

5. Following language is added for Western Pond Turtles on page 42. "Although no sensitive-status wildlife species were observed during site survey work riparian corridor, wetlands, and dredge ponds could provide potential foraging and breeding habitat for the pond turtle. Potential impacts from construction will be minimized as work is scheduled to occur outside the March 1 – August 1 nesting season, a pre-construction survey will be conducted and wetland and dredge ponds will be avoided. In addition, the 318 acre property is owned and protected by DFG and in the future could be designated as an ecological reserve; together with the improvements for aquatic and associated upland habitats provided by the project the pond turtle will have a permanent sanctuary. This is similar to the conservation actions for the pond turtle outlined in the Multi Species Conservation Plan for the CALFED program."

6. The following language is added to the first paragraph on page 52 under Section 4.5.2.2 Proposed Project: "The change in the physical environment by the project will not substantially impact the economic or social aspects of the

area (CEQA guidelines Section 15064 (f)). For this project, a significant socioeconomic impact is presumed to occur if there is a substantial impact to the following; Land-use designation change; Noise attenuation; displaced housing; and loss of jobs.

The current zoning, A-2, exclusively agriculture, will not change. This project will not impact existing agricultural parcels. Restoration and aggregate extraction will occur over the five years. Existing public access for fishing and other recreational activities at the MRR is more fully discussed in the Recreation and Public Safety section. Public access will be limited during the restoration and extraction activities; however at a minimum, there will be a return to the access levels provided prior to the Project once theses activities are complete. This project will use public funds on public land (the MRR is owned by CDFG) and some public access and educational opportunities will be provided once the Project is complete.

The proposed project work is funded under the Central Valley Improvement Act Anadromous Fish Restoration Program (AFRP) and is part of the Merced River Corridor Restoration Plan (MRCRP) previously funded by the AFRP. The MRCRP is a 10-year plan aiming to restore or rehabilitate ecosystem processes in the Merced River. The annual budget for this project may be viewed each year in the AFRP Annual Work Plan(s) posted on http://www.usbr.gov/mp/cvpia/docs_reports/awp. For fiscal year 2010 the project budget is $295,220.00.

This project will provide income to the local economy by hiring local temporary workers. A local contractor will perform the grading and aggregate extraction.

Stabilizing salmonid spawning habitat may increase spawning in the river and contribute to the long-term goal of increasing natural populations of salmonids and trout in the Merced River. Restoration and increases salmonid production will have long-term economic and intrinsic community benefits. The potential increase in anadromous fish production will have a positive, long-term effect on the regional commercial and sport fishery industries. The level of this effect cannot be quantified.

7. On page 70; Greenhouse Emissions Discussion there is a correction; 2 weeks should be changed to 5 – 6 weeks. All reduction measures mentioned will be implemented and this does not change the level of significance.

8. Add mitigation measure #2 identified on page 17 to the VI: Hydrology and Water Quality Discussion page 71.

9. On page 73 Section VII: Air Quality Hydrology Discussion add the following text: “The project was designed to implement Best Management Practices to address potential air quality impacts. As well as Basic Air Quality Control Measures at the project site, including, but not limited to, watering dirt roads

and construction areas. And gravel plant and loader equipment operation would be limited to Monday through Friday, except holidays, from 6:30 AM to 5:00 PM to reduce potential public exposure."

10. Correction on the checklist Page 85. Cultural Resources (d) (e) should be checked less than significant with mitigation. The document includes Mitigation Measure #13 to address this impact.

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This document should be cited as:

California Department of Fish and Game and U.S. Fish and Wildlife Service (CDFG and USFWS). 2010. Environmental Assessment/Initial Study for Merced River Ranch Floodplain Restoration Project. April 2010. California Department of Fish and Game 1234 E. Shaw Ave. Fresno, CA 93710.

1.0 INTRODUCTION

This Environmental Assessment/Initial Study (EA/IS) has been prepared to identify and assess the anticipated environmental impacts of the United States Fish and Wildlife Service (USFWS) Anadromous Fish Restoration Program (AFRP) and California Department of Fish and Game's (CDFG) proposed Merced River Ranch (MRR) Floodplain Restoration Project. This EA/IS document prepared by USFWS AFRP and CDFG will satisfy both the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). The MRR project site is a 6,500 ft (~2000 m) stretch of the lower Merced River between river mile (RM) 50 and 51, approximately one mile downstream of Crocker-Huffman Dam, adjacent to the Cuneo Fishing Access Site (Figure 1).

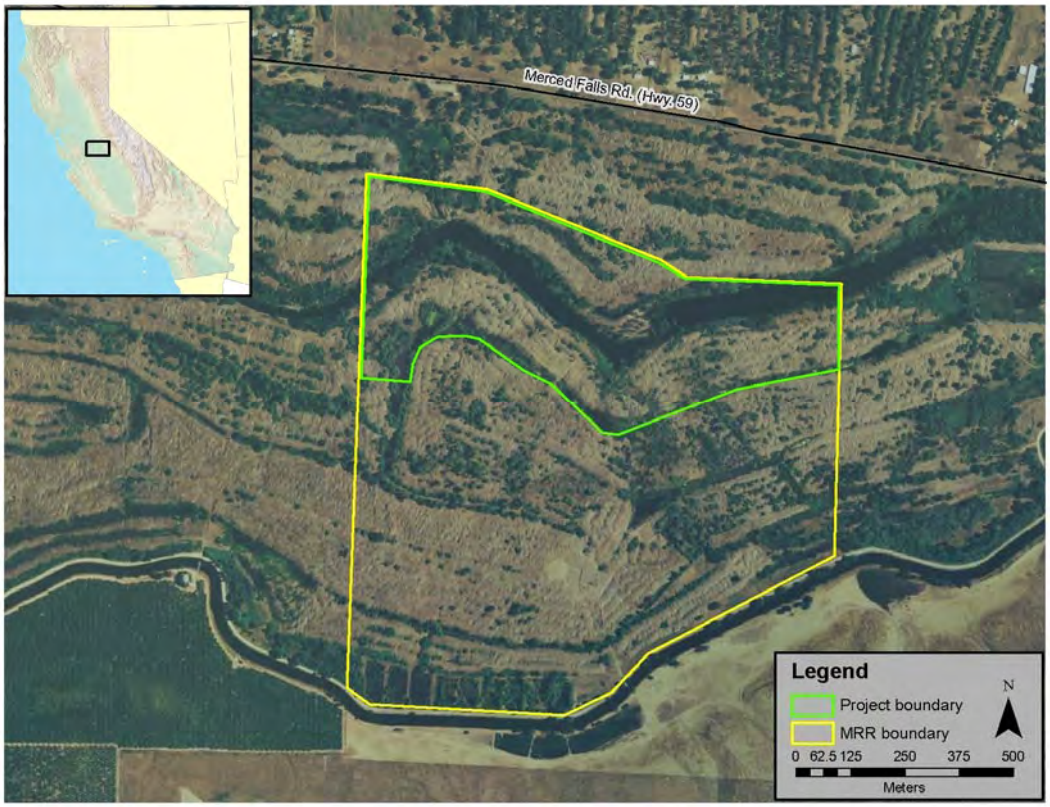

Figure 1. Map of the Merced River Ranch and the project boundary (N 37.56243, W -120.43853).

The property was purchased by CDFG in 1998 for the primary purpose of protection, enhancement and restoration of the valuable riparian, wetland and aquatic habitats along the Merced River (CDFG 1998). The purpose of this study is to address specific impacts that may result from implementing the proposed habitat restoration project. The restoration of the floodplain inundation and gravel augmentation will improve spawning and rearing conditions for salmonids. This document relies on various site-specific studies and published reports that address in detail the effects or impacts associated with the project. In addition, this project was evaluated in the Ecosystem Restoration Program (ERP) in the CALFED Bay-Delta Program (CALFED 2000). The ERP vision for the Merced River includes maintaining suitable water temperatures, restoring stream flow, restoring coarse sediment recruitment with gravel augmentation, restoring stream channel and riparian habitat, and ecological functions and

processes to improve habitat for fall and late-fall run Chinook salmon *Oncorhynchus tshawytscha*, steelhead *O. mykiss*, riparian vegetation, and wildlife resources, restoring more natural channel configuration to restore gravel recruitment, transport, and cleansing processes. In addition to this study, various documents and studies have been developed in preparation for site restoration (Stillwater Sciences 2004a, b, c; URS 2004a, b; Stillwater Sciences 2005, 2006; URS 2006a, b, c; Geomatrix and Stillwater Sciences 2007). This project is consistent with the larger programmatic view on environmental management and restoration shared by several state and federal agencies.

In the California Department of Water Resources (DWR) comprehensive salmonid assessment (DWR 1994), salmon habitat restoration sites were identified in the Merced River from Crocker-Huffman Dam to Oakdale Road, including sites within the MRR and recommendations include replacing gravel, cobble and structure. Recommendations of the San Joaquin River Management Plan (1995) also suggest improving gravel quality to increase survival of salmon eggs and enhance the channel and riparian corridor of the Merced River. The USFWS (1995) Working Paper on salmonid restoration in the Central Valley identified the need to restore and protect instream and riparian habitat in the Merced River to ensure the long-term sustainability of physical, chemical, and biological conditions needed to meet production goals for Chinook salmon. The Merced River is listed as high priority in the Final Restoration Plan (USFWS 2001), and collaboration among landowners, Merced County, CDFG, USFWS, and U.S. Bureau of Reclamation (USBR) for projects that improve watershed management to restore and protect instream and riparian habitat, including restoring and replenishing spawning gravel, are also high priority. Project objectives of the MRR floodplain restoration project fit into the framework of salmonid population recovery on the Merced River and are aligned with the following AFRP goals: 1) involve local partners in the implementation and evaluation of restoration actions; 2) improve habitat for all anadromous life stages through improved physical habitat; and, 3) collect fish population, health, and habitat data to facilitate evaluation of restoration actions (USFWS 2001). This EA/IS is an informational document used in the local planning and decision-making process. The EA/IS is not intended to recommend approval or denial of the project. California Department of Fish and Game has prepared this EA/IS to determine whether the project would have a significant effect on the environment. The purposes of this EA/IS are:

- to provide the lead agency with information to use in deciding whether to prepare an Environmental Impact Statement/Environmental Impact Report (EIS/EIR) or a negative declaration;
- to enable the lead agency to modify the project to mitigate adverse impacts before an EIS/EIR is prepared, thereby enabling the project to qualify for a negative declaration; and,
- to document the factual basis for the finding, in a negative declaration, that a project will not have a significant effect on the environment.

As lead agency, CDFG is required to circulate an EA/IS for public review before adopting it. This document is being circulated for a 30-day review period. A notice will be posted at the Snelling, CA post office that includes a project description and the location where the document is available for interested parties to review. The EA/IS will be available from the CDFG Regional Office, 1234 E. Shaw Avenue, Fresno, CA 93710. Copies are also available by request from the CDFG Regional Office. Any comments should be returned to USFWS AFRP 4001 N. Wilson Way, Stockton, CA 95205 attention Michelle Workman, or to the CDFG Regional Office, attention Julie Vance. Additionally, USFWS anticipates attending the Snelling Municipal Advisory Council Meeting in upcoming months where they will discuss this AFRP-funded project and provide ‘notice of availability’ and the location where EA/IS is available. The CDFG

intends to adopt a Mitigated Negative Declaration (MND) for this project. Before adopting the project, the USFWS and CDFG must consider the proposed EA/IS along with any comments received during the public review process. If the USFWS and CDFG find, on the basis of this EA/IS and any comments received, that the study adequately addresses the environmental issues associated with the project and that no substantial evidence indicates that the project would have a significant effect on the environment, a Finding of No Significant Impact (FONSI) will be prepared and the MND will be adopted. Adoption of the proposed EA/IS does not require implementation of the project.

1.1 Central Valley Project Improvement Act (CVPIA)

There are a series of documents regarding the Merced River, which rely on the analyses already decided in the broader programmatic review (CALFED 2000). The broader programmatic review is used to guide specific projects. The AFRP is a component of a broader program, the Central Valley Project Improvement Act (CVPIA), which supports provisions for fish and wildlife habitat restoration. The CVPIA program prepared a programmatic environmental impact statement (USBR 1999) and Record of Decision (ROD) (USBR 2001) in accordance with National Environmental Policy Act (NEPA). A programmatic environmental document is frequently used to evaluate new programs, analyze a series of actions that are part of a larger project, or consider broad policy alternatives and programmatic mitigation measures. This document was prepared to address details and site-specific factors of the restoration action near the Merced River. This EA/IS for the Merced River Ranch Floodplain Restoration Project is consistent with the CALFED and CVPIA programs, and adopts appropriate provisions of the CVPIA's ROD. This EA/IS has been prepared to assess the impacts of the proposed project as required by the California Environmental Quality Act (CEQA) and the State CEQA Guidelines (Public Resource Code Sections 21000-21178.l). The USFWS is the lead agency under NEPA and CDFG is the lead agency under CEQA for the proposed project.

1.1.1 Anadromous Fish Restoration Program (AFRP)

The CVPIA authorizes and directs the Secretary of the Department of the Interior (DOI), in consultation with other state and federal agencies, Indian tribes, and affected interests, to develop and implement a program which makes all reasonable efforts to at least double natural production of anadromous fish in California Central Valley rivers and streams. Anadromous fish include the Chinook salmon, steelhead, striped bass *Morone saxatilis*, American shad *Alosa sapidissima*, white sturgeon *Acipenser transmontanus*, and green sturgeon *A. medirostris*. Fall-run Chinook salmon and steelhead trout are the primary management focus in the river because of the salmon's value as a sport and commercial fishery, and the listing of steelhead by the National Marine Fisheries Service (NMFS) as threatened. Further, the CVPIA requires that this program give first priority to measures that protect and restore natural channel and riparian habitat values through habitat restoration actions, modifications to Central Valley Project operations, and implementation of the supporting measures mandated by the CVPIA. The DOI approached implementation of this directive through AFRP development, with the USFWS assuming lead responsibility. The AFRP encourages local citizens and groups to share or take the lead in implementing restoration actions. This approach is consistent with California's Coordinated Regional Strategy to Conserve Biological Diversity (Available: http://biodiversity.ca.gov/) in which 26 state and federal agencies emphasize regional solutions to regional problems. The successful implementation of the MRR floodplain restoration project would contribute to salmonid recovery goals of the river and provide public outreach and education opportunities to local citizens and stakeholders.

1.2 Purpose and Need

The Merced River system and its associated habitats have been affected by European-American activities for more than a century, beginning with extensive gold mining in the 1850s. Since that time, riparian and instream habitats have been modified or converted for uses such as agriculture, gravel mining, water impoundments, increased water diversions, decreased instream flows, levees, and more recently, urban development. These major actions and other events have led to the deterioration of riparian and aquatic habitat conditions on the lower Merced River. In spite of habitat modifications, Chinook salmon and steelhead trout populations are still present in the lower reaches of the Merced River below Crocker-Huffman Dam.

Two habitat deficiencies in the Merced River are a lack of suitable gravel for salmonid reproduction and functional floodplain for salmonid rearing. The Merced River and its floodplain have been historically mined for both gold and aggregate, and aggregate mining continues on the floodplain today. Large-scale aggregate mining began in the Merced River in the 1940s. Older mines excavated sand and gravel directly from the riverbed, leaving behind deep pits within the channel. More recent mines have been located on floodplains and terraces adjacent to the river. These mines are typically separated from the river by narrow berms. Many of the berms at older mines have been breached, resulting in direct connection of many of these floodplain mines to the river channel (Stillwater Sciences 2001). Reduction in flows and associated reduction in sediment transport in the lower Merced River have further modified the river's geomorphological and hydrological processes. Eliminating the natural processes has resulted in limited gravel recruitment and immobility or compaction of the gravel that remains available for salmonid spawning, in addition to a disconnection of the floodplain from the active channel that historically would have provided rearing habitat for juvenile fish. This project is intended to restore salmonid spawning and rearing habitat lost as a result of mining and other modifications to the natural geomorphological processes.

Chinook salmon are the most abundant native salmonid within the lower Merced River and demonstrate an example of a keystone species (Merz and Moyle 2006). Therefore, management actions which enhance Chinook salmon health and production will confer benefits to the overall health and production of the lower Merced River and contribute to population maintenance. Juvenile fall-run Chinook salmon emerge in early to mid-winter (Figure 2) and are immediately susceptible to the influence of flow (Allen and Hassler 1986; Moyle et al. 2007). Displacement and dispersal to lower velocity habitats shortly follows, assuming such refugia are present. Side-channel and floodplain habitats serve to dissipate flow in areas where these complex in- and off-channel habitat associations exist; thereby providing suitable refugia for newly emerged fish.

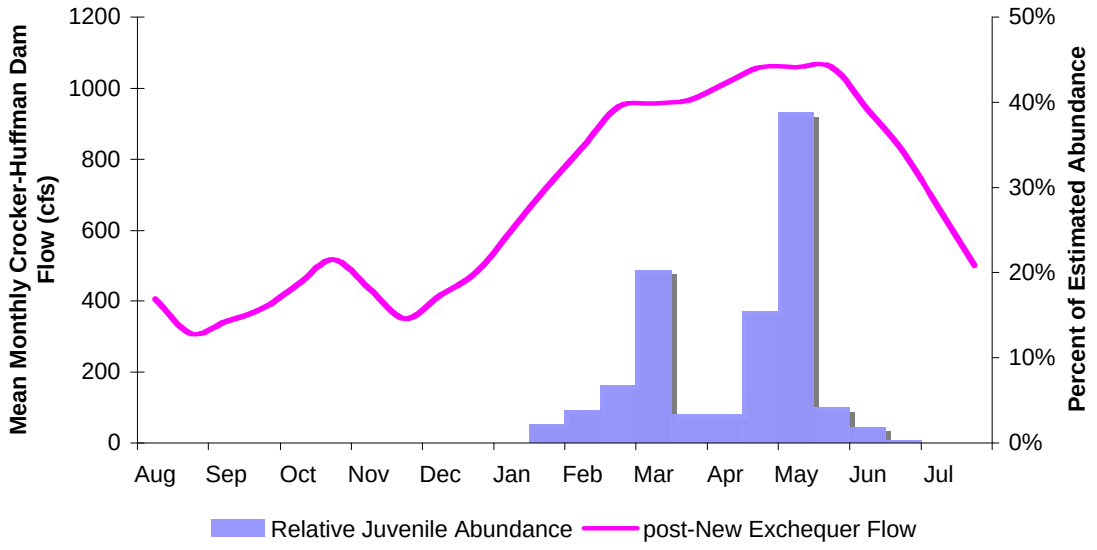

Figure 2. Mean daily discharge (Q) by month in the lower Merced River and relative juvenile Chinook salmon abundance estimated at Hagaman State Park (1998–2002; CDFG, unpublished data); flow data from MID gauging station at Crocker-Huffman Dam from 1967–2007 (post New Exchequer).

Salmonid spawning and rearing habitat in this section of the Merced River has been determined to be deficient because of several limiting factors. Construction of four dams on the Merced River, including the largest and most downstream, New Exchequer Dam, has impeded the movement of coarse gravels through the river system. These series of dams and reservoirs trap natural sediment sources. Chinook salmon and steelhead trout require these coarse gravels for successful spawning and incubation (Groot and Margolis 1991; Moyle 2002). This "armoring" process may render the riverbed to be unsuitable for salmon spawning (Kondolf 1997; Kondolf 2000), and degrades other physical habitat values. Consequently, areas downstream of dams lack recruitment of salmonid spawning gravels from areas upstream of the present dam sites (Vogel 2007). Additional large-scale and long-term gravel augmentation has been recommended to increase Chinook salmon habitats (Stillwater Sciences 2001). As a second stressor, reduction of the magnitude and duration of peak flows of winter and spring runoff flows decrease the ability for the river to transport course sediment entering lower sections of the Merced River (Figure 3). Historic gravel mining operations within the river channels and active lower floodplains have added a third stressor to the coarse sediment recruitment and transport needs of the river by depleting the natural supply to downstream sites, altering the migration corridor, and creating juvenile salmon predator habitat (CDFG 1993). Compounding these issues are the perched gravel and cobble terraces left behind from historic gold mining and subsequent scouring of the active channel due to flow regulation. The unnaturally high and coarse floodplain is now effectively disconnected from the entrenched channel, reducing rearing habitat for juvenile Chinook salmon and steelhead, and reducing the ability of the floodplain to develop and support a healthy riparian system.

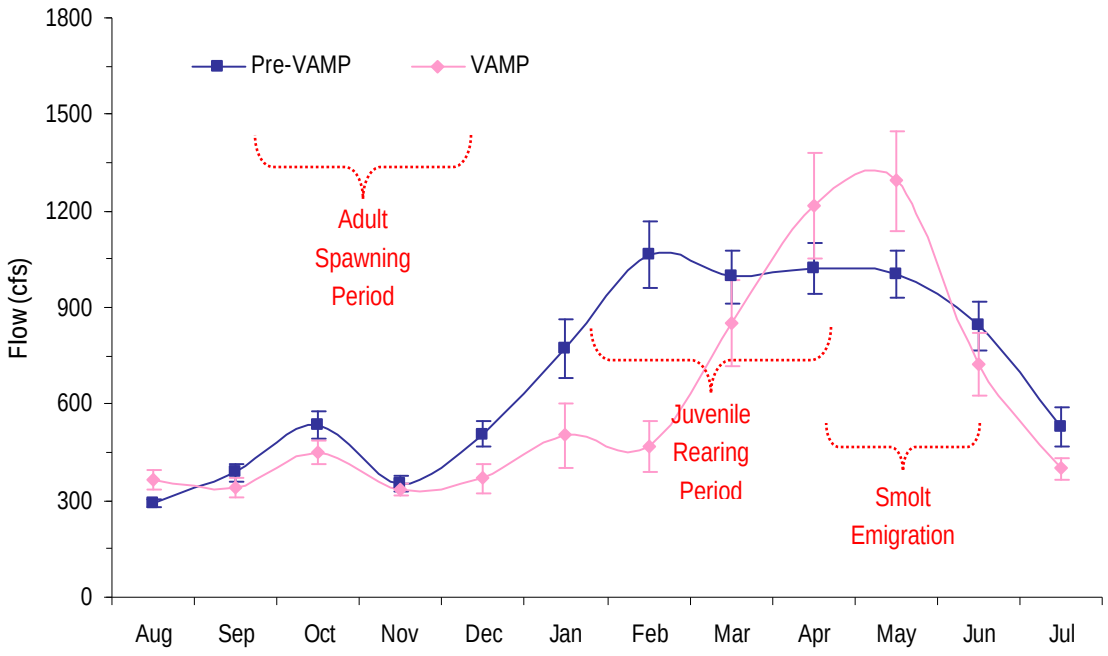

Figure 3. Mean daily discharge (Q) by month for the lower Merced River; flow data from MID gauging station at Crocker-Huffman Dam from 1967–2007 (post New Exchequer). Pre-VAMP flows include years 1980–1999 while VAMP flows include years 2000–2007.

In general, dispersal and migratory patterns of juvenile Chinook salmon increase the use of available rearing areas while movements consist of complex local migrations (upstream, downstream, or both) that are genetically and environmentally controlled (Murray and Rosenau 1989). Juvenile salmon may migrate into off-channel habitats to exploit food resources, seek optimal temperatures, and escape unfavorable environmental conditions in the main channel such as predators and high turbidities (USFRHAC 1989). Components of high quality juvenile salmonid rearing habitat typically include appropriate water temperatures, suitable dissolved oxygen concentrations, decreased water velocity, overhanging vegetation for cover and source of terrestrial insects for food, in-water natural wood structure, and suitable substrate for cover and benthic macroinvertebrate production.

The overall vision for the proposed project is to restore (i.e., rehabilitate and enhance) channel, floodplain and riparian ecosystem processes and critical habitats for juvenile and adult salmonids, in coordination with local communities and stakeholders, to promote the recovery of healthy and diverse Chinook salmon and steelhead populations in the Merced River, while helping to meet the abundance goals of the AFRP. The vision is considered in the context of historic land use and current water management constraints and meets objectives outlined in previous planning efforts for the Merced River Ranch (Stillwater Sciences 2005). In order to realize maximum benefits from the rehabilitation of side-channel and floodplain habitats, the project was designed to flow and inundate at regular intervals, both within and among years at the current hydrologic regime (Figure 4).

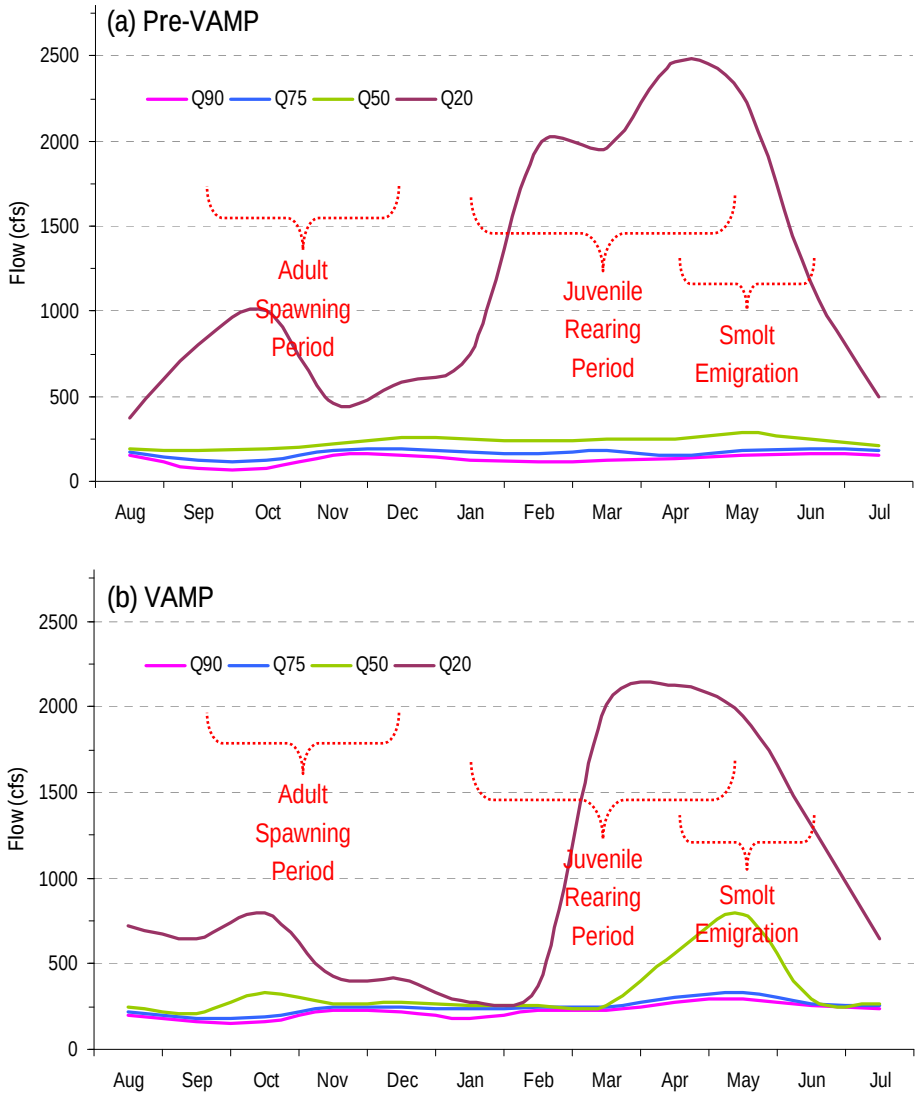

Figure 4. Discharge (Q) by month for 90%, 75%, 50%, and 20% exceedance levels on the lower Merced River; flow data from MID gauging station at Crocker-Huffman Dam from (a) 1980–1999 (i.e., pre-VAMP) and (b) 2000–2007 (i.e., VAMP).

Flow data was analyzed from 1936 to 2007 to develop exceedance curves to determine the frequency and duration of various flow scenarios, and will use post-dam (i.e., New Exchequer) flow data (1967–2007) and guidance from local constituents and the scientific community to determine appropriate flow standards for project design (see Figures 4 (a) and (b)).

The Merced River Ranch Floodplain Restoration Project goals are as follows:

- serve as an example of publicly-supported applied fisheries and restoration science;
- augment, rehabilitate and enhance productive juvenile salmonid rearing and adult spawning habitat in the Merced River; and,
- determine project effectiveness with an efficient and scientifically-robust monitoring program.

1.3 Project Setting and Location

The proposed project site is a section of the lower Merced River located east of Snelling, California in Merced County (see Figure 1), within the Dredger Tailings Reach (DTR) of the river. The DTR is a heavily impacted area of the lower Merced River, and most of the adjacent land use is rural agricultural. The Merced River is a tributary to the San Joaquin River and supports five species of anadromous fish. The property proposed for restoration is known locally as the Merced River Ranch (318-acre [128.7-hectare] parcel). Restoration activities include removing piles of tailings from two areas of the floodplain to restore elevation and side channel connectivity; and, augmenting in-channel gravel supplies with properly-sized, processed material from the floodplain (Figure 5). Restoration actions will be phased, and will occur over a five-year period.

The property was purchased by CDFG in 1998 for the primary purpose of protection, enhancement and restoration of the valuable riparian, wetland and aquatic habitats along the Merced River (CDFG 1998). This project will restore floodplain inundation and provide juvenile rearing habitat, along with improving gravel conditions for spawning salmonids. The CDFG has determined that the stretch of river between Crocker-Huffman Dam and the confluence with the San Joaquin River is of considerable importance for maintenance and restoration of Chinook salmon and steelhead (CDFG 1998). This area was chosen because it is known to have supported fall-run Chinook salmon and steelhead trout spawning and rearing in the past and because the substrate and floodplain are suitable for habitat improvement.

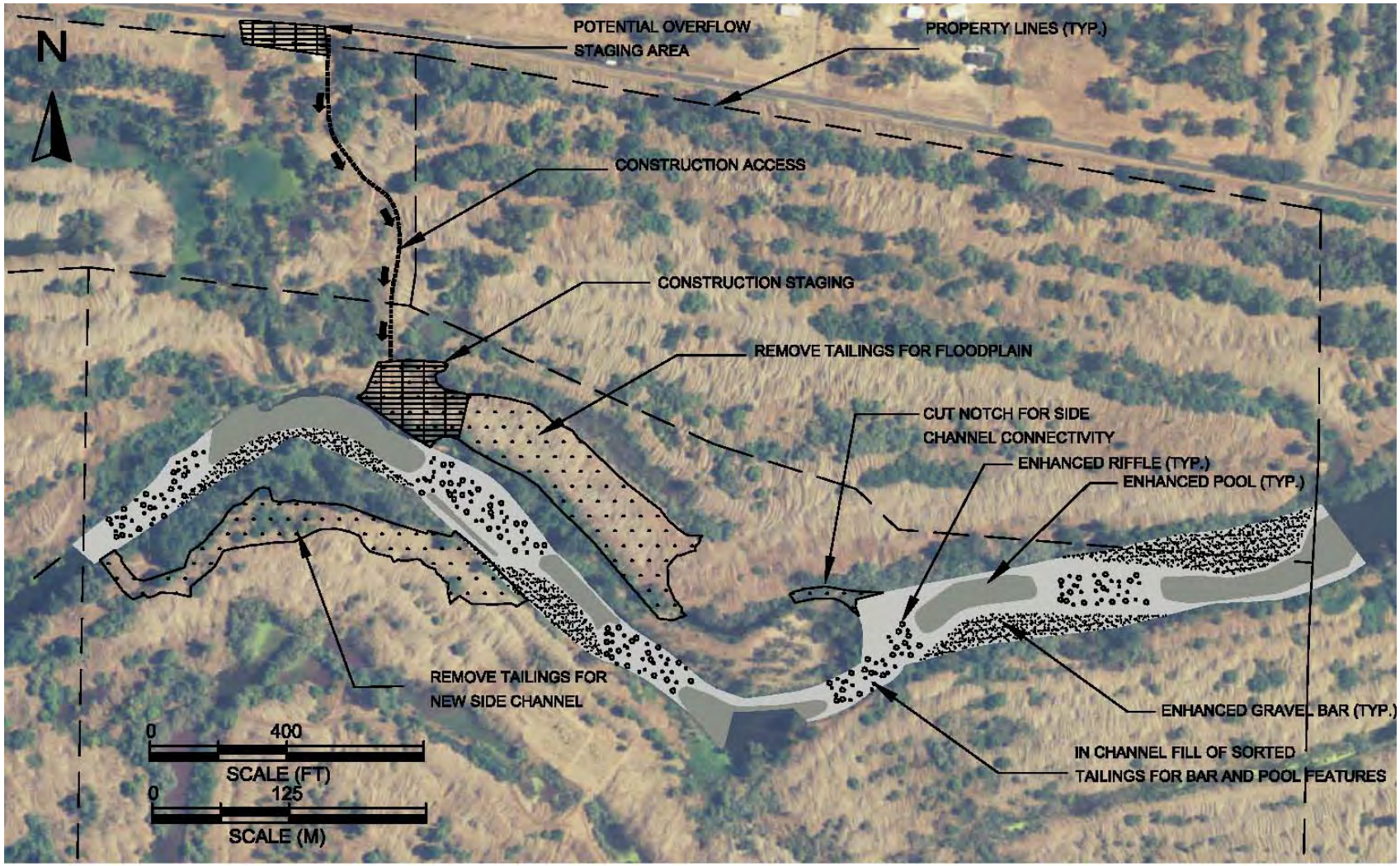

Figure 5. Aerial imagery of the Merced River Ranch with floodplain grading and gravel augmentation areas indicated. Note, access point and temporary construction staging area.

2.0 PROJECT DESCRIPTION

The objectives of the proposed project are to restore (i.e., rehabilitate and enhance) channel, floodplain and riparian ecosystem processes and critical habitats for juvenile and adult Chinook salmon and steelhead at the MRR, in coordination with local communities and stakeholders, and to promote the recovery of healthy and diverse Chinook salmon and steelhead populations in the Merced River. This project is a collaborative effort by CDFG, AFRP, and Cramer Fish Sciences (CFS), building on the work of Stillwater Sciences and others, as well as long-term coordination with the local community (Stillwater Sciences 2006). The proposed spawning gravel replenishment and floodplain rehabilitation activities will increase available and usable spawning areas for salmonids by providing spawning gravels within the appropriate size range; increase use of spawning habitat (Merz and Setka 2004); improve gravel permeability and intergravel water quality (Merz et al. 2004); and, decrease redd superimposition. Increased gravel substrate will also increase production of aquatic invertebrates (Merz and Chan 2005), the food base for juvenile salmonids and other important organisms. Recovering floodplain inundation will provide rearing habitat for juvenile salmon that may contribute to improved growth conditions (Sommer et al. 2001), and recover processes to promote the native plant community. In 1998, the CDFG acquired the MRR with the goals of protecting riparian habitat, improving conditions for salmonids, and supporting some public access (CDFG 1998). Several existing state and federal plans supported these goals. Gravels recovered and processed during the construction process will be used in the restoration actions of instream gravel augmentation (see Figure 5). ***No gravel will leave the project site as a result of this project and no gravel will be stockpiled.***

This project is being funded by the AFRP in partnership with CDFG. Restoration planning began with Phase I of the Merced River Corridor Restoration Plan, funded by AFRP. The Merced River Stakeholders (MRS) and Technical Advisory Committee (TAC) were established during Phase I planning, and tasked with providing input throughout the duration of the project. The primary goal of Phase I was to provide a technically-sound, publicly-supported and feasible plan to restore habitat for fish populations in the lower 52 miles of the Merced River. The plan extent is from Crocker-Huffman Dam to the confluence with the San Joaquin River, and includes the DTR in which MRR is contained. Phase II of the process was funded by CALFED in 1998, and consisted of baseline investigations into the geomorphic and riparian vegetation characteristics of the project reach (Stillwater Sciences 2001a). These investigations include the DTR and also identify social, institutional, and infrastructural opportunities and constraints for restoration (Stillwater Sciences and EDAW 2001). In 2000, CALFED funded Phase III that included the development of the Merced River Corridor Restoration Plan (Stillwater Sciences 2002) and a series of public workshops to present the plan and receive input from MRS, TAC, and the public.

The restoration plan identifies objectives and actions based on the scientific understanding of the Merced River. To guide restoration planning and address the various environmental impacts in the DTR, the plan identified the following specific restoration objectives:

- balance sediment supply and transport capacity to allow the accumulation and retention of salmonid spawning gravel;
- restore floodplain functions that foster recruitment of riparian vegetation and the quality of riparian habitat;
- increase in-channel habitat complexity to improve aquatic habitat for native aquatic species; and,

- re-engineer the low-flow and bankfull channel geometry so that it is scaled to function properly under current (regulated) flow conditions and to prevent riparian vegetation encroachment in the active channel.

From 2003–2006, Phase IV of the planning process built upon the Phase III plan with funding from the California Bay-Delta Authority (CBDA). The Phase IV objective was to design pilot floodplain and channel restoration experiments at MRR to initiate the restoration of natural ecosystem function, and to develop monitoring and evaluation plans to improve scientific understanding of the driving processes for floodplain restoration and inform future projects.

2.1 Assumptions for Alternative Developments

Basic assumptions that influenced the development of the proposed project include:

- Stream flow in the project area, which is controlled by the Merced Irrigation District (MID) directly via releases from New Exchequer Reservoir, is suitable for salmon and steelhead;
- Limitations on flows exceeding 1,500 cubic feet per second (cfs) minimize course sediment (i.e., spawning gravel) transport in the project area;
- Existing Land Use: DTR of the Merced River is heavily impacted from mining activities and the property was purchased by CDFG in 1998 for restoration;
- Adjacent landowners support instream restoration projects; and,
- Equipment entrance to the river would have minimal impacts to the stream corridor, riparian vegetation and any sensitive habitats.

2.1.1 Previous Salmonid Habitat Improvement Efforts

On the Merced River, a series of previous salmonid habitat improvement efforts have been completed. For example, gravel pits have been filled in several locations. CALFED provided about 1.6 million (1999) to partially fill and isolate the Ratzlaff gravel pit. Approximately $2 million more was provided to this project from a fund designed to mitigate post-1986 increased fish kills at the Sacramento Delta water diversion pumps, and an additional $250,000 was contributed from AFRP, making the total cost around $4 million to isolate this pit. In the Robinson Reach of the Merced River, CALFED initially provided $2.43 million in 1998; and an additional $1.7 million in 2001, to isolate a gravel pit (Kondolf et al. 2002). Floodplain restoration also occurred in the Robinson Reach.

The MRR has been extensively studied, as part of the planning process for these restoration activities. Brady (2001) developed the first conceptual designs at MRR, and restoration planning continued with Phase I of the Merced River Corridor Restoration Plan, funded by U.S. Fish and Wildlife Service's AFRP. Phase I established the Merced River Stakeholder Group (MRS) and Merced River Technical Advisory Committee (TAC). The MRS and TAC were formed to provide input to the baseline studies (Phase II) and the restoration planning process (Phase III). The MRS provided input from a broad spectrum of interests in the watershed, including landowners, riparian water users, aggregate miners, dairy operators, ranchers, farmers, environmental groups, and local management and regulatory agencies. The TAC provides focused technical input to study designs and reviews draft study reports. Phase II baseline investigations assessed the geomorphic and riparian vegetation characteristics of the project reach (Stillwater Sciences 2001). These investigations include the several mile reach near MRR, and also identify social, institutional, and infrastructural opportunities and constraints for restoration (Stillwater Sciences and EDAW 2001). In 2000, CALFED funded Phase III that included the

development of the Merced River Corridor Restoration Plan (Stillwater Sciences 2002) and a series of public workshops to present the plan and receive input. From 2003–2006, Phase IV of the planning process was to design pilot floodplain and channel restoration experiments at MRR to initiate the restoration of natural ecosystem function, and to plan monitoring and evaluation plans to improve scientific understanding of the driving processes for floodplain restoration and inform future projects (Stillwater Sciences 2004a, b, c; URS 2004a, b; Stillwater Sciences 2005, 2006; Geomatrix and Stillwater Sciences 2007). In Phase V of this work the project plan will be reviewed, revised, permitted, and implemented, building on the work of the previous phases.

2.1.2 Previous Environmental Documents

Salmon spawning gravel improvements for the lower Merced River have been identified as priority actions in USFWS's Working Paper (USFWS 1995) and the AFRP Final Restoration Plan (USFWS 2001); in the California Department of Water Resources (DWR) (1994) comprehensive assessment for Chinook salmon; and, in several CDFG publications (CDFG 1990, 1993, 1996) as part of the effort to improve spawning habitat for fall-run Chinook salmon and steelhead trout in the Merced River. In addition, the following environmental documents have addressed the issues being considered at the MRR:

- ***CVPIA and AFRP.*** In Section 3406(b)t, the Secretary of the Interior is required to develop and implement a program that makes all reasonable efforts to double natural production of anadromous fish in Central Valley rivers and streams by 2002. In response to this directive, USFWS prepared a draft plan for the AFRP and identified anadromous fish habitat deficiencies in each tributary within the Central Valley (USFWS 2001). The Merced River system was identified as High Priority with the need to "improve watershed management to restore and protect instream and riparian habitat, including consideration of restoring and replenishing spawning gravel" (USFWS 2001). The following studies were completed as part of AFRP's restoration planning for the Merced River and the MRR:

    - Brady (2001) developed the first conceptual designs at MRR, and restoration planning continued with Phase I of the Merced River Corridor Restoration Plan.

    - Phase I of the Merced River Corridor Restoration Plan established the MRS group and Merced River TAC. The MRS and TAC were formed to provide input to the baseline studies (Phase II) and the restoration planning process (Phase III). The MRS provided input from a broad spectrum of interests in the watershed, including landowners, riparian water users, aggregate miners, dairy operators, ranchers, farmers, environmental groups, and local management and regulatory agencies. The TAC provides focused technical input to study designs and reviews draft study reports.

    - Phase II baseline investigations assessed the geomorphic and riparian vegetation characteristics of the project reach (Stillwater Sciences 2001). These investigations include the DTR, and also identify social, institutional, and infrastructural opportunities and constraints for restoration (Stillwater Sciences and EDAW 2001).

- ***The CALFED Bay-Delta Program*** is a cooperative state and federal effort established to reduce conflicts in the Delta by solving problems in ecosystem and water quality, water supply reliability, and levee and channel integrity. In its Ecosystem Restoration Program Plan (ERPP) (CALFED 2000), the goal is to improve and increase aquatic and terrestrial habitats and improve ecosystem functions in the Delta to support sustainable populations of diverse and valuable plant and animal species. The ERPP vision for the Merced River includes maintaining suitable water temperatures, restoring stream flow, restoring coarse sediment recruitment, restoring stream channel and riparian habitat and ecological functions and processes to improve habitat for fall-run Chinook

salmon, late-fall run Chinook salmon, steelhead, riparian vegetation, and wildlife resources, restoring more natural channel configuration to restore gravel recruitment, transport, and cleansing processes.

- In 2000, CALFED funded Phase III that included the development of the ***Merced River Corridor Restoration Plan*** (Stillwater Sciences 2002) and a series of public workshops to present the plan and receive input.

- From 2003–2006, The ***Merced River Corridor Restoration Plan*** Phase IV (CALFED ERP-02-P12-D) evaluated strategies for channel and floodplain restoration in the DTR of the Merced River (RM 45 – 52) within the context of the contemporary flow regime, and to plan monitoring and evaluation plans to improve scientific understanding of the driving processes for floodplain restoration and inform future projects (Stillwater Sciences 2004a, b, c; URS 2004a, b; Stillwater Sciences 2005, 2006; Geomatrix and Stillwater Sciences 2007).

- The ***San Joaquin River Management Plan (SJRMP) (1995)*** recommends projects and studies to be conducted on the mainstem San Joaquin River and its tributaries to address factors that currently limit populations of aquatic species. The SJRMP recommends for the Merced River improving gravel quality to increase survival of salmon eggs and enhance the channel and riparian corridor, among other things (SJRMP 1995).

- The ***CDFG*** recommends habitat rehabilitation in the Merced River as part of the fisheries management strategies in several reports including Salmon and Steelhead restoration and enhancement plan (1990), Restoring Central Valley Streams - A Plan for Action (1993), and Steelhead Restoration and Management Plan (1996), and Strategic Plan for Trout Management (2003). In 1998, the California Department of Fish and Game (CDFG) acquired the MRR with the goals of protect riparian habitat, improving conditions for salmonids, and supporting some public access (CDFG 1998).

- The initial ***Federal Energy Regulatory Commission (FERC)*** license for the Merced River water system (Project) expires February 28, 2014. Merced Irrigation District (MID) intends to apply to FERC for a new license (Relicensing) using FERC's Integrated Licensing Process (ILP), as described in Title 18 of the Code of Federal Regulations (CFR), Subchapter B, Part 5. Consistent with these regulations, MID intends to file with FERC a notice of intent to apply for a new license and a pre-application document after September 1, 2008 but no later than February 28, 2009. MID plans to file an application for new license by February 28, 2012. MID has filed the following documents so far: notice of intent, pre-application document, and a proposed study plan. The FERC relicensing process is based on laws and regulations that require a minimum of five years of extensive planning, environmental studies, agency consultation, and public involvement that are described below. The process has changed considerably since the original Merced River Hydroelectric Project license was issued in 1964. The Federal Power Act was amended by the Electric Consumers Protection Act (ECPA) in 1986 and the Energy Policy Act in 2005. Among other things, ECPA requires FERC to give "equal consideration" to power production (the purpose of the license), energy conservation, and water quality, recreation, and other non-power benefits of the natural resources, such as fish and wildlife conservation. Five special status fish species are potentially impacted by the project including Chinook salmon and steelhead trout which must be considered throughout the relicensing process. The National Oceanic and Atmospheric Administration (NOAA) has recommended studies on sediment budget and ecosystem study; MID has yet to include these studies in the proposed study plan.

Spawning gravel restoration is recommended by the DWR, AFRP, CALFED, SJRMP, and CDFG. The FERC relicensing procedure currently in progress with MID may also be supported by gravel augmentation which also mediates water temperatures. The actions undertaken at the MRR could be substantially beneficial to anadromous fish in the Merced River.

2.2 Proposed Action

2.2.1 Site Selection

The MRR was chosen as a key restoration site in the Merced River. The following factors were important in determining site selection:

- existing condition (e.g., poor gravel quality or quantity; poor inter-gravel conditions);
- potential for enhancement (suitable gradient; suitable depth);
- physical access to the site to allow equipment entrance that would have minimal impacts on the stream corridor, riparian vegetation, any sensitive species habitat, local community); and,
- landowner participation.

2.2.2 Existing Conditions

Five anadromous fish species: fall-run Chinook salmon; steelhead, Pacific lamprey *Lampetra tridentate*, striped bass, and American shad; and, three species of special concern, Kern brook lamprey *L. hubbsi*, hardhead *Mylopharodon conocephalus*, Sacramento splittail *Pogonichthys macrolepidotus* are encountered in the lower Merced River (CDFG 2001; NRS, Inc., unpublished data; Stillwater Sciences 2002) at the MRR, in the vicinity of where restoration activities will occur. The Central Valley steelhead distinct population segment is listed as threatened under the federal Endangered Species Act (NMFS 2000), and the Merced River and adjacent riparian habitat downstream of Crocker-Huffman Dam were included in the final critical habitat designation for this species in 2005 (NOAA 2005). Prior to dam construction, the Merced River is believed to have supported both spring-run and fall-run Chinook salmon (Yoshiyama et al. 2000). Chinook salmon and steelhead are the primary focus of management efforts. Fall-run Chinook salmon in the Merced River typically emigrate to the ocean in the spring of their first year (NRS, Inc., unpublished data; Montgomery et al. 2007, 2008) and spend two to four years in the ocean before returning to their natal stream to spawn (CDFG, unpublished data). Crocker-Huffman Dam (RM 52) is the uppermost extent of fish migration limiting all anadromous species and life stages to the low gradient lower river. Natural salmon production is limited as the historic access to spawning and rearing habitat in higher elevation river reaches is restricted, and dramatically reduces the suitable available habitat. Salmon returns have declined in the Merced River when looking at returns in the past two 17-year periods from an average of 6,322 (1974–1990) to 4,347 (1991–2007) (CDFG, unpublished data). Chinook salmon natural production estimates during 1995–2000 (5,378 – 16,372) fell considerably short of the AFRP production goal (18,000) (USFWS 2001).

2.2.3 Project Characteristics

The proposed project would take place in the reach of the river just below Crocker-Huffman Dam, and before the Snelling Bridge (RM 50 – 51), over a 5-year period. The project includes a detailed effectiveness monitoring program to determine its success in terms of wetland function and habitat for salmonids.

2.2.4 Design and Construction Activities

The proposed project consists of re-grading and rehabilitating ~6 acres (~2.4 ha) of dredger tailings on the historic floodplain and ~5.5 acres (~2.2 ha) of salmonid spawning habitat. Over a 5-year period, the floodplain will be graded and material from the floodplain will be screened to appropriate size classes (¼ to 5 in [0.6 to 12.7 cm] of round river rock; AFRP specifications) and

approximately 56,000 yd^3 (42,815 m^3) of this material placed within the spawning channel. The strategy for replenishment is based on an understanding of the existing channel bed topography (Stillwater Sciences 2004a; CFS, unpublished data) and the average grain size distribution of sediments available from the dredger tailings (URS 2004b), and is intended to re-create channel bedforms favorable to spawning of native aquatic species. Gravel will be placed in configurations designed by incorporating the Spawning Habitat Integrated Rehabilitation Approach (SHIRA) developed by the University of California, Davis (Wheaton et al. 2004a, b; Pasternack 2008; Sawyer et al. 2008), and general rearing habitat components at each site, for five consecutive years. The SHIRA approach incorporates a 2-D hydraulic model with a sediment mobility index and a habitat suitability model. The result is a design to enhance spawning habitat based on the unique hydraulic and sediment conditions at each site for the quantity of gravel placed.

Gravel for the enhancement project will be quarried from land adjacent to the Merced River located on the MRR property. The volume and texture of dredger tailings at the MRR has been analyzed and discussed previously; see URS (2004a) and Stillwater Sciences (2005) for a detailed discussion. In summary, volume and texture analysis of the dredger tailings at the MRR indicates that the tailings contain enough material of the desired size range to provide both the coarse infill and bedform facies material required by the 75% level restoration design (URS 2004a, 2006a). This area comprises a small part of an estimated 2.4 million yd^3 (1.8 million m^3) of dredger tailings deposited between 1932 and 1952 in the area near the town of Snelling, CA (URS 2006a). For the purposes of the MRR restoration, tailings will be sorted to exclude top soil, fines, and large cobble. The resulting mixture will be highly beneficial for aquatic habitat purposes, and will not contribute to reductions in water quality for the lower Merced River. An onsite gravel processing plant will be established in the MRR where dredger tailing material will be processed and sorted by contractors. This processing plant, associated equipment, and work area will have an approximate footprint of 200 ft X 200 ft (61 m X 61 m), and will all be removed following restoration work. Smooth, uncrushed river rock of the appropriate size will be transported (i.e., by steam-cleaned tractor-trailer transfer trucks with a capacity of 7 – 20 tons) and staged onsite. Gravel will be deposited in-stream and manipulated by a rubber-tired front-end loader (3 – 5 yard capacity). This equipment will travel from the staging area to the enhancement site using private roads and easement areas associated with the restoration site footprint (see Figure 5). To mitigate for negative effects on anadromous fish, in-stream gravel placement activities will occur during late summer, when controlled flow releases from New Exchequer Dam and salmonid use are at a minimum. Construction will require approximately 4 – 6 weeks annually, with in-stream construction work requiring 10 – 20 days annually. Gravel placement will take place during the period from 1 August to 1 October.

The gravel processing will be done under a grading permit from Merced County, issued to the contractors. Areas on the north and south banks (see Figure 5) will be re-graded from 1 – 20 ft (0.3 – 6.1 m) in elevation, and in the process form windrows of three different bed material types. Separate rows will consist of: 1) 5 – 10 in (12.7 – 25.4 cm) cobbles that will be used to build up the base layer of each riffle; 2) ¼ – 5 in (0.6 – 12.7 cm) of gravel that will be placed 2 – 3 ft (0.6 – 0.9 m) deep at each riffle site; and, 3) fines less than ¼ in (0.6 cm). Materials less than ¼ in (0.6 cm), including organic materials such as humus will be used to provide a soil matrix for re-vegetation of riparian plant communities. All gravel to be used for this project will be obtained from within the MRR project area so that none would be transported over county or state roads.

Approximately 112,000 yd^3 (85,630 m^3) of dredger tailings will be extracted from the floodplain area (84% from the north bank; 16% from the south bank) and processed to obtain the ~53,000 yd^3 (40,521 m^3) of gravel needed to rehabilitate salmonid spawning gravel beds within the project

site (see Figure 5). The remaining 59,000 yd^3 (45,109 m^3) would contain ~17% (10,030 yd^3 [7,668 m^3]) material < ¼ in (0.6 cm) and 83% larger cobble (5 – 10 in [12.7 – 25.4 cm] in size). The smaller material will be used for revegetation of portions of the floodplain and upland areas within the project footprint. The larger cobble would be used as a base layer at each riffle site before the addition of the spawning gravel to provide increased bed stability in high flow events and habitat heterogeneity throughout the site. Approximately 13,000 yd^3 (9,939 m^3) of cobble will also be used to fill deep holes in the channel profile and create the designed channel slope.

Mitigation Measure 1. Native trees, such as Fremont cottonwood *Populus fremontii*, oak *Quercus* spp., and willow *Salix* spp. with a diameter-at-breast-height (DBH) of 6 in (15.2 cm) or greater will be protected with 30-ft (9.1-m), 10-ft (3-m), and 10-ft (3-m) buffers, respectively. Native trees will be marked with flagging and fenced if close to project work area to prevent disturbance. To compensate for the removal of riparian shrubs and trees during project implementation, the plans would identify tree and shrub species that would be planted, how, where, and when they would be planted, and measures to be taken to ensure a minimum performance criteria of 70% survival of planted trees for a period of three consecutive years. Irrigation will not be used, but the return of inundation to the floodplain is expected to promote growth of native riparian species. If the 70% survival criteria are not met, more native trees will be planted and irrigation will be evaluated. The tree plantings would be based on native tree species compensated for in the following manner:

- Oaks having a DBH of 3 – 5 in (7.6 – 12.7 cm) would be replaced in-kind, at a ratio of 3:1, and planted during the winter dormancy period in the nearest suitable location to the area where they were removed. Oaks with a DBH of greater than five inches would be replaced in-kind at a ratio of 5:1.
- Riparian trees (i.e., willow, cottonwood, poplar, alder, ash, etc.) and shrubs would be replaced in-kind and on site, at a ratio of 3:1, and planted in the nearest suitable location to the area where they were removed.

All equipment will be clean and use biodegradable lubricants and hydraulic fluids. The screening process will specifically separate fine materials from appropriate-sized spawning materials. It will further provide specific size classes of gravel, as well as collecting fine materials for use in the floodplain restoration component of the project. Clean gravels will be added to the river using the front-end loaders. Boulders and large woody debris found on sight may also be placed in the main and side channels, as available. Once gravel is processed and transported to staging areas near the river (see Figure 5), it would be placed in the river using front-end loaders for the SHIRA method and by dump trucks for the Stockpile Injection method. Front-end loaders would be wheeled (rubber tire) to minimize impacts. Construction specifications would require that any equipment used in or near the river to be properly cleaned to prevent any hazardous materials from entering the river, and containment material would be on site in case of an accident. Contracted construction personal would regularly monitor contractors to insure environmental compliance.

New Zealand mudsnails *Potamopyrgus antipodarum*, an introduced species, have been identified in numerous rivers of the Central Valley. While they have not been observed in the lower Merced River at the time of this document, to minimize the chance that the snails would be transported and introduced to other water bodies on equipment, construction specifications would require that equipment be steam cleaned immediately after the work is completed and before being used in other water bodies. Additional measures may be taken at the recommendation of CDFG.

Front-end loaders would pick up a bucket of gravel from the stockpile, and drive from the stockpile into the river and carefully dump the gravel in a manner as to distribute it across the river bottom according to design parameters. Placement would proceed starting with the river access site and working out into the river from there. This would allow the loaders to drive on the newly placed gravel, thereby avoiding driving in overly deep water. The loader would distribute the gravel along the river bottom to create the hydraulic conditions necessary for salmonid spawning and other parameters as required in the design.

2.2.5 Best Management Practices (BMPs)

The proposed action includes the following BMPs to minimize adverse environmental effects. Cramer Fish Sciences anticipates that additional, or more detailed, BMPs will be identified during the permitting process. Best Management Practices that would be included in this project include, at a minimum, the following: 1) water quality; 2) air quality and traffic; and, 3) vegetation, fish and wildlife.

2.2.5.1 Water Quality

Historically, mercury was used to separate gold from excavated alluvial deposits throughout the western United States, resulting in potential mercury contamination in dredger tailings piles along rivers. Excavation and regrading of dredger tailings during restoration activities could expose and mobilize mercury contamination to the Merced River (Stillwater Sciences 2004c). It is possible that during MRR restoration activities, exposed mercury and amalgam could be introduced directly into the Merced River and the associated aquatic food chain if appropriate steps are not taken. At the MRR, the feasibility of removing mercury during processing was assessed (Stillwater Sciences 2004c). Study results indicated relatively low mercury levels throughout sampled tailings piles (1.0 – 6.5 nanograms per liter [ng/L]), but that the highest levels of mercury were associated with fine grain-size fractions (<2 millimeters), and that mercury levels were documented in the surrounding wetland ponds and swales. The water and bio-indicator sampling results indicate mercury contamination within the system but suggest that the dredger tailings contribute relatively low levels of mercury to the Merced River.

To minimize potential environmental health impact to the surrounding area, restoration work will avoid surrounding wetland ponds and associated swales. Furthermore, batch testing of processed rocks and retained solids will be performed weekly during construction to confirm the lack of mercury contamination at the site.

Mitigation Measure 2. Following methods in the Stillwater Sciences (2004) Mercury Assessment, total mercury from sediments will be evaluated to insure samples are below or within the range of natural background levels (50–80 ng/g) for California's Central Valley (Bouse et al. 1996). All samples previously collected were below this level (Stillwater Sciences 2004). Aqueous raw total mercury was also found to be below the California Toxics Rule for a drinking water source of 50 ng/L. In-river channel aqueous raw total mercury was at or below levels measured at relative control sites for the Cache Creek watershed (Slotton et al. 2004), a highly mining-impacted watershed in Northern California which has been identified for regulatory and remedial action with regard to mercury (Stillwater Sciences 2004). It is unlikely that excavation and regrading activities may uncover mercury hot spots and or mobilize mercury in the aquatic food web; however, if samples are found with mercury levels above established standards, work will be halted to assess contamination potential. As a further precaution, mercury levels will be measured before, during, and after restoration activities in the MRR area.

During in river work, turbidity would be monitored with intermittent grab samples from the river, and construction curtailed if turbidity exceeds criteria established by the Regional Water Quality Control Board in its Clean Water Act §401 Water Quality Certification. All equipment working within the stream channel would be inspected daily for fuel, lubrication, and coolant leaks; and, for leak potentials (e.g. cracked hoses, loose filling caps, stripped drain plugs). Furthermore, all equipment would be steam cleaned prior to working within the stream channel to remove contaminants that may enter the river and adjacent lands; and, vehicles are to be fueled and lubricated in a designated staging area located outside the stream channel and banks. Spill prevention kits will be located close to construction areas, with workers workers trained in its use.

2.2.5.2 Air Quality and Traffic

Basic Air Quality Control Measures would be implemented at the project site, including, but not limited to, watering dirt roads and construction areas.

Gravel plant and loader equipment operation would be limited to Monday through Friday, except holidays, from 6:30 am to 5:00 pm to avoid recreational use impacts during the weekend.

2.2.5.3 Vegetation, Fish and Wildlife

In-river work would be limited to July 15 through September 30 to avoid the spawning and embryo/larvae incubation period for Chinook salmon, steelhead and other sensitive fish species.

Nesting birds and raptors are protected under the MBTA and California Fish and Game Code. Trees and shrubs within the project area likely provide nesting and roosting habitat for songbirds, raptors and/or bats. If tree removal is unavoidable, it will occur during the non-breeding season (mid-September through January). If other construction activities must occur during the potential breeding season (February through mid-September) surveys for active nests and/or roosts will be conducted by a qualified biologist no more than 30 days prior to the start of construction.

Mitigation Measure 3. To meet CDFG's recommendations for mitigation and protection of Swainson's hawks *Buteo swainsoni*, surveys will be conducted by a qualified biologist for a ½ mile radius around all project activities. Site surveys will be conducted to identify suitable foraging and roosting habitat and species presence, in accordance with CDFG survey guidelines. The no-disturbance buffer should be a minimum of 0.25 mi (0.40 km) around any identified nests. If State-listed species are found to be nesting in the project area, CDFG will be notified to discuss project implementation and avoidance of take. Note, this project also provides for Swainson's hawk conservation: by restoring the river landscape and ecosystem processes that support riparian forests. Swainson's hawks have strong association with riparian forests which suggests that protection and restoration of these habitats may provide nesting habitat superior to other sources of trees such as roadsides and field margins. Bird species that occupy the mature tree and gallery forest component of riparian systems will also benefit from conservation or restoration of nesting habitat for Swainson's Hawk (Woodbridge 1998).

Sensitive vegetation (e.g., native trees, elderberry shrubs) in the near vicinity of construction areas would be flagged and fenced.

All equipment entering the river would be steam cleaned before it is used elsewhere to minimize the chance of introducing New Zealand mudsnails to other water bodies. Additional measures may be taken at the recommendation of CDFG.

2.2.6 Post-Construction Erosion Control Measures

The end result of the surface grading will be a level area with a very slight slope from upstream to downstream. As an erosion control measure, the topography and vegetation of the gravel extraction and processing area will be stabilized by redistributing the soil and planting. Approximately 7,140 yd^3 (5,459 m^3) of fine material such as sand and topsoil will be produced at the MRR from processing the gravel needed to rehabilitate the gravel beds. Approximately ~6 acres (~2.4 ha) of floodplain area will be recovered with the use of fine materials and topsoil produced through gravel processing. Currently, there is very little topsoil at the MRR so most will be created on-site. To create topsoil on-site, if necessary, all removed woody vegetation, except tree of heaven *Ailanthus altissima*, a non-native invasive species, will be chipped, mulched, and then mixed with the stockpiled topsoil and some of the sand recovered from the gravel screening process. Tree of heaven will be removed from the project site and disposed of at an approved waste facility to minimize further spread of this species.

2.2.7 Restoration and Revegetation of Disturbed Area

After floodplain grading and gravel augmentation activities have been completed the disturbed areas will be revegetated with native riparian plants. Planting at MRR will occur in late November, which is the likely beginning of the winter storm season, to maximize survival rates. Exotic species present in the riparian area, including tree of heaven, Himalayan blackberry *Rubus discolor*, yellow starthistle *Centaurea solstitialis* and milk thistle *Silybum marianum*, will be eradicated where possible. A detailed monitoring program will document the pre-project conditions, restoration and revegetation, and the effectiveness of the planting in terms of vigor and survival.

2.2.8 Time Frame

Construction is expected to start in late July to August 2010 and be completed by October of each year through 2014 assuming all permits and licenses are finalized as expected. Floodplain grading and gravel processing would begin at MRR in early August, after the gravel processing plant has been established on-site in July. Sorting will continue through the summer, and gravel augmentation activities will occur in mid-August following CDFG guidelines for instream restoration work. Streamflows are expected to be very low during this time. All gravel placement activities will be completed by the end of September before the salmonid spawning season begins. Replanting will commence at the beginning of the rainy season, which will presumably begin in late November. Monitoring of the replanting success will occur for three years through at least the fall of 2017. If data indicate survival is less than 70%, reason for poor survival will be evaluated and addressed, and more native trees will be planted.

2.2.9 Work Hours

Construction activities would take place during normal working hours, 6:30 am to 5:00 pm, Monday through Friday.

2.2.10 Funding

The total estimated cost of this proposed project is ~$2,000,000. The AFRP provided $226,732 by the end of 2009, and estimates an additional ~$500,000 – $600,000 will be needed annually through 2014.

2.2.11 Monitoring

The monitoring program has been adapted from the Technical Memorandum #9 Merced River Ranch Channel-Floodplain Restoration: Post-Implementation Monitoring Plan (Stillwater Sciences 2006). Metrics outlined in this plan have been consolidated and revised to better fit the project's target objectives and the focus of AFRP. Assessment of restoration actions should include three types of monitoring: implementation; effectiveness; and validation (MacDonald et al. 1991; Kershner 1997; Mulder et al. 1999). Time scales, project aspects, and objectives addressed will vary among the types of monitoring (Table 1).

Table 1. Monitoring types for the MRR restoration project (Stillwater Sciences 2002).

Type of Monitoring	Question Addressed	Time Frame
Implementation	Was the project installed as planned?	1 – 6 months
Effectiveness	Was the project effective at meeting restoration objectives?	1 year to decades
Validation	Are the basic assumptions behind the project conceptual model valid?	5 – 10 years

The program addresses all types of monitoring, and utilizes a Before-After-Control-Impact (BACI) study design structure to test the differences between the non-restored and restored sites (Green 1979; Stillwater Sciences 2006). This approach can utilize a paired series of Control-Impact sites, subjected to a series of Before-After replicated measurements, referred to as the paired BACI design (Bernstein and Zalinski 1983; Stewart-Oaten et al. 1986; Smith 2002). Robust statistical assessment is possible because the design includes spatial and temporal replication. The monitoring program takes an 'Ecosystem Perspective' as described by the Adaptive Management Forum (2002) by tracking physical and biological parameters; and the structural and functional responses by the restored ecosystem. Links in scientific input, project design, and implementation factors are intact and continuously refined. Out-migration data will be evaluated in coordination with AFRP, Natural Resources Scientists, Inc. and MID to assess any population-level responses. Furthermore, spatial databases in ArcGIS will be developed to provide ease of information transfer among partners, opportunities for spatial analyses of results, and development of graphic public outreach materials. All habitats for listed species are identified and protected (or enhanced). Finally, water quality data are assessed to determine the potential for mercury and other types of contamination in partnership with California Water Quality Control Board.

The monitoring program includes implementation monitoring to document that the project was installed following design standards and met all permitting requirements. Implementation monitoring will answer the following questions: 1) Does the constructed topography/bathymetry match design plans?; 2) Does duration and magnitude of flooding match design plans?; 3) Does planted vegetation (i.e., species, sizes, locations) match design plans?; and, 4) Was native vegetation retained matching design plans? Parameters collected will include elevation and bathymetry, hydrology and flooding inundation, and vegetation surveys. Data will also be used in the effectiveness and validation portions of the monitoring program. Implementation addressed the project's target objectives by developing an ecologically sound project that functions within current hydrograph, restoring connectivity and complexity to the Merced River floodplain, and increasing native vegetation. Effectiveness monitoring will determine if the project created habitat conditions suitable for juvenile Chinook salmon rearing, spawning and incubation, and increased the abundance of native plants in the riparian community. Effectiveness monitoring efforts will answer the following questions: 1) Are habitat conditions in project area suitable for juvenile Chinook salmon rearing?; 2) Are rearing conditions significantly

different than the reference site?; 3) Are habitat conditions in project area suitable for adult Chinook salmon spawning, egg incubation and development?; 4) Are spawning conditions significantly different than the reference site?; 5) Was there an increase in native vegetation in the project area?; and, 6) What physical factors affect the success of native plantings? A variety of parameters and biological conditions will be tracked throughout the monitoring period including, for example, water temp, dissolved oxygen, turbidity, prey resource composition and availability, suitable cover, low density of predators, sediment composition, intergravel conditions, etc. Our methods for effectiveness monitoring will include field surveys. Data provided by those surveys will also be used in the validation monitoring.

Onsite experiments to test overall project assumptions regarding the benefit of recovered side channel and seasonally inundated floodplain habitat to juvenile salmonids (validation monitoring) will be conducted, following the Phase IV monitoring plan (Stillwater Sciences 2002). Experiments will test hypotheses about the benefit to spawning Chinook salmon of gravel-bed enhancement following methods outlined in Merz et al. (2004) and Wheaton et al. (2004a, b), and use a bioenergetics model to assess juvenile Chinook salmon performance in the non-restored and restored sites. The bioenergetics model is a powerful tool to assess habitat in terms of potential fish growth and has been used by other researchers aiming to assess restoration success (Sommer et al. 2001; Madon et al. 2001; Gray 2005). By demonstrating the benefit available to spawning and rearing fish, especially in the BACI context, the work should increase our understanding of mechanisms of channel enhancement and floodplain restoration, and the links between healthy ecosystem, hydrologic and geomorphic processes (Merz et al. 2004; Wheaton et al. 2004a, b). Validation monitoring will address the following questions: 1) Does restoring floodplains recover productive habitat for salmonid rearing?; and, 2) Does restoring in-channel coarse sediment processes recover productive habitat for salmonid spawning? These experiments will test the overall assumption of the restoration work, by assessing the function of the restored habitats and the potential for these habitats to contribute to the overall production of Chinook salmon in the river. Results will thus contribute to a better overall understand of the function of restored habitats for salmonid populations in the Central Valley. Our methods for all monitoring will include gathering rigorous information on the following physical and biological parameters to address our hypotheses and questions regarding salmonid habitat function. We will track several parameters including: river discharge, flooding inundation, groundwater levels, topography, sediment characteristics, water quality, mercury testing, and biological conditions, i.e., vegetation, fish communities and wildlife. Detailed methods, supplies, and sampling schedules are available in the MRR Restoration Monitoring Program (CFS 2010).

2.3 Alternatives Eliminated from Further Consideration

One alternative is the restoration of the historical, geomorphic, and hydraulic channel conditions of the river prior to major human manipulation. This alternative would: 1) increase streamflows to simulate historic flow duration and timing; 2) restore the historical channel meander pattern within the project reach; 3) fill all captured mine pits that occur immediately upstream and downstream of the project area; 4) remove dams, berms, and enlarge the floodplain to restore normal hydraulic scour of gravel and the silt depositional processes; and, 5) inject gravel annually to restore the natural rate of gravel recruitment to the project area. Together, these actions would produce high quality salmonid habitat and a historically natural riparian community and river channel. This alternative would improve spawning and rearing habitat for salmonids, and meet the objectives of the project and programmatic goals of AFRP. However, this alternative is not feasible and thus was eliminated from consideration due to the extreme cost of implementing this alternative.

In addition, floodplain restoration was considered on a much larger scale (Stillwater Sciences 2005), however flood flows currently available would not meet the design standards established. Although large amounts of suitable habitat may have been created for salmonids and other species of interest, the project design was not feasible without changes to the existing water rights allocations. This alternative was also expensive with total costs ranging up to ~$26,000,000.

2.4 No Action Alternatives

The No-Action alternative would consist of no funding for restoration activities and there would be no change to the existing conditions.

3.0 REQUIRED PERMITS AND APPROVALS

The following permits/authorizations are required to implement the proposed project:

Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act

The U.S. Army Corps of Engineers is authorized to issue permits for discharges of dredged or fill material into waters of the United States. Applications will be made for a Nationwide Permit 27 for the restoration of wetland and riverine habitats and a Nationwide Permit 33 for the construction of temporary access routes.

Section 401 of the Clean Water Act

State water quality standards cannot be violated by the discharge of fill or dredged material into waters of the U.S. The State Water Quality Control Board, through the Central Valley Regional Water Quality Control Board, is responsible for issuing water quality certifications, or waivers thereof, pursuant to Section 401 of the Clean Water Act.

Federal Endangered Species Act (ESA)

Section 7 of the ESA requires all Federal agencies to consult with the USFWS and National Marine Fisheries Service (NOAA Fisheries) to ensure that their actions do not jeopardize the continued existence of endangered or threatened species or result in the destruction or modification of the critical habitat of these species. The Secretary of Commerce, acting through NOAA Fisheries, is involved with projects that may affect marine or anadromous fish species listed under ESA. All other species listed under the ESA are under USFWS jurisdiction.

California Endangered Species Act, California Fish and Game Code 2081 and 2090

The California Endangered Species Act (CESA) allows CDFG the ability to authorize, by means of an incidental take permit, incidental take of state-listed threatened, endangered or candidate species if certain conditions are met. For CDFG projects, routine internal coordination occurs whenever CDFG proposes a project which may impact a state-listed species of plant or animal. The CDFG strives to ensure that no threatened or endangered species would be adversely affected by their projects, even for projects otherwise exempt from the California Environmental Quality Act (CEQA). When CDFG proposes to undertake a project that has the potential for take of a state-listed species, if the project is part of the management of that species, i.e., for the protection, propagation, or enhancement of the species and its habitat, CDFG is not required to get a CESA Incidental Take Permit per California Code of Regulations, Title 14, Section 783.1. However,

CDFG is still required to complete its obligations under CEQA and prepare a Negative Declaration or an EIR, as appropriate, for the proposed project,

The Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act requires Federal agencies to consult with USFWS, NOAA Fisheries, and state fish and wildlife resource agencies before undertaking or approving water projects that control or modify surface water. The AFRP will work to ensure the proposed project's compliance with the Fish and Wildlife Coordination Act.

The essential fish habitat (EFH) provisions of the Magnuson-Stevens Fishery Conservation and Management Act of 1996

The EFH provisions require federal agencies to consult with NOAA Fisheries on project actions that may adversely affect the habitats of the west coast salmon fisheries and other fisheries managed in federal waters.

Fish and Game Code Section 1600 et. seq., Streambed Alteration Agreement

California Department of Fish and Game has regulatory authority with regard to activities occurring in streams and/or lakes that could adversely affect any fish or wildlife resource, pursuant to Fish and Game Code Section 1600 et seq. Authorization is required for proposed projects prior to any activities that could substantially divert, obstruct, result in deposition of any debris or waste, or change the natural flow of the river, stream, or lake, or use material from a stream or lake.

California State Reclamation Board Encroachment Permit

The Reclamation Board issues permits to maintain the integrity and safety of flood control project levees and floodways that were constructed according to flood control plans adopted by the Board of the State Legislature.

State Lands Commission Land Use Lease

The State Lands Commission has jurisdiction and management control over those public lands received by the state upon its admission to the United States in 1850 that generally include all ungranted tidelands and submerged lands and beds of navigable rivers, streams, lakes, bays estuaries, inlets, and straits.

National Historic Preservation Act, Section 106

Projects must coordinate with the State Historic Preservation Office and the Advisory Council on Historic Preservation regarding the effects that a project may have on properties listed, or eligible for listing, on the National Register of Historic Places. Section 106 also requires Federal agencies to evaluate the effects of Federal undertakings on historical, archaeological, and cultural resources. The AFRP will work to ensure the proposed project has compliance with Section 106 of the National Historic Preservation Act.

San Joaquin Valley Air Pollution Control District

The San Joaquin Valley Air Pollution Control District requires that all portable equipment registrations are obtained for all project equipment.

The following Executive Orders and Legislative Acts have been reviewed as they apply to the Proposed Action, and the following permits/authorizations are required to implement the proposed action:

National Environmental Policy Act

This joint EA/IS was prepared pursuant to regulations implementing the NEPA (42 USC 4321 et seq.). National Environmental Policy Act provides a commitment that Federal agencies would consider environmental effects of their actions. This EA/IS provides information regarding the No-Action Alternative, the Proposed Action, and their environmental impacts. If, after certain key permits are obtained and the final EA/IS is released, the Proposed Action is found to have no significant environmental effects, a "finding of no significant impact" would be filed.

Floodplain Management - Executive Order 11988

Executive Order 11988 requires that all Federal agencies take action to reduce the risk of flood loss, to restore and preserve the natural and beneficial values served by floodplains, and to minimize the impact of floods on human safety, health, and welfare. The project is within the 100-year floodplain. The Proposed Action supports the preservation and enhancement of the natural and beneficial values of floodplains and is in compliance with Executive Order 11988.

Protection of Wetlands - Executive Order 11990

Executive Order 11990 requires Federal agencies to follow avoidance, mitigation, and preservation procedures with public input before proposing new construction of wetlands. The EA/IS has identified that the restoration actions would not result in the net loss of any wetlands. Implementation of the proposed restoration could enhance wetlands or increase their area, and is in compliance with Executive Order 11990.

Environmental Justice in Minority and Low-income Populations-Executive Order 13007-Executive Order 12898

Executive Order 12898 requires Federal agencies to identify and address disproportionately high and adverse human health and environmental effects of Federal programs, policies, and activities on minority and low-income populations. The Proposed Action has considered the environmental, social, and economic impacts on minority and low-income populations and is in compliance with Executive Order 12898.

Indian Trust Assets, Indian Sacred Sites on Federal Land-Executive Order 13007, and American Indian Religious Freedom Act of 1978

These laws are designed to protect Indian Trust Assets, accommodate access and ceremonial use of Indian sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites, and protect and preserve the observance of traditional Native American religions, respectively. The Proposed restoration activities and their associated mitigation measures would not violate these protections.

4.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

4.1 Surface Water and Hydrology

4.1.1 Affected Environment

The proposed project will occur in an approximately 6,500 ft (~2,000 m) reach of the lower Merced River just below Crocker-Huffman Dam at the MRR site. Gravels will be excavated from dredger tailings piles on the river banks, sorted and processed onsite, and then placed in the main channel to improve rearing and spawning habitat for juvenile salmonids. The proposed area is designated as Non-prime Agriculture in the Merced County General Plan. Specific land uses in this area include wildlife habitat, recreation and agriculture. The "Resources" section of the General Plan states that may be used to manage the production of natural resources. Implementation of the proposed project may contribute to the production of Merced River salmonids. The proposed project has been identified in many state and federal planning documents (CDFG 1998; USFWS 2001; Stillwater Sciences 2002). Improvement in salmonid habitat in the Merced River has been identified by DWR's comprehensive habitat plan (DWR 1994); USFWS' Working Paper (USFWS 1999), and Final Restoration Plan (USFWS 2001); San Joaquin River Management Plan (1995); several CDFG documents; and is expected in upcoming FERC relicensing efforts in 2014. The project does not conflict with any applicable habitat conservation plan or natural community's conservation plan. The proposed project has been generally or specifically described in several state and federal planning documents. The proposed project is consistent with applicable environmental plans or policies adopted by agencies with jurisdiction over the project. The proposed project has the potential to recover juvenile and adult salmonid habitat, and improve the overall functioning of the lower Merced River.

4.1.2 Criteria for Determining Significance

Impacts to surface water would be considered significant if they result in increased based flood elevations upstream and downstream of the project area by more than 0.1 ft (0.03 m) as specified by The Reclamation Board.

4.1.3 Environmental Consequences

4.1.3.1 No Action Alternative

If the proposed project is not implemented the existing conditions, water quality and disturbed hydrologic processes would continue as they are now. Available habitat for salmonids would continue to degrade as the channel becomes more incised and continue to be disconnected from the natural floodplain due to the prior placement of dredger tailings. Native riparian vegetation recruitment and floodplain function in terms of juvenile salmonid habitat would continue to be degraded due to hydrologic and topographic changes from historic mining activities.

4.1.3.2 Proposed Project

The proposed project would have no impact on surface water flows or groundwater availability or use. Philip Williams and Associates (PWA) used the HEC-2 to model and compare flood patterns with and without the project surface elevation changes. They concluded that the proposed habitat work would have no impact on the designated floodway. The PWA engineers'

analysis was expanded to the entire project area to ensure that no impacts will occur. The proposed project recovers habitat functions lost with flow regulation of upstream reservoirs by augmenting the gravel delivery process. The benefits of this project are expected to be long-term, because high flows capable of mobilizing gravel are relatively infrequent in the Merced River.

4.2 Water Quality

4.2.1 Affected Environment

The lower Merced River provides water for agricultural uses, municipal and domestic supply, recreation, and fish and wildlife habitat. In the lower Merced River, water quality data have been collected primarily through U.S. Geological Survey (USGS) National Ambient Water Quality Assessment (NAWQA) Cycle I activities (1991–2001). Surface water quality in the lower Merced River is characterized by seasonal highs in agricultural pesticide concentrations (Dubrovsky et al. 1998), generally low nutrient (nitrogen and phosphorus) concentrations (Dubrovsky et al. 1998), and low total mercury and methylmercury levels (Stillwater Sciences 2004c). During 1992–1995, surface water pesticide concentrations did not exceed applicable drinking water standards, but they did exceed the criteria for the protection of aquatic life for diuron and trifluralin (herbicides), and azinphos-methyl, carbaryl, chlorpyrifos, diazinon, and malathion (insecticides) (Dubrovsky et al. 1998). Peak diazinon concentrations in the lower Merced River frequently exceeded levels that can be acutely toxic to some aquatic life. Nitrate concentrations in the San Joaquin River have been increasing over the past 40 years, but concentrations are still well below the drinking-water standard (10 mg/L). Measured ammonia concentrations have been generally low, both in the DTR (Table 2), and in the lower Merced River (Dubrobsky et al. 1998). Total mercury concentrations in unfiltered river water ranged from 1.0–6.5 ng/L total mercury and from <0.03 – 0.44 ng/L methylmercury (bioavailable form of mercury) during fall 2003 sampling of the DTR. However, values were one to two orders of magnitude greater in the floodplain swales, where prime mercury methylation conditions exist (Stillwater Sciences 2004c). Table 2 presents the water quality conditions during fall 2003 in the MRR as part of sampling activities within the DTR.

Table 2. Water quality parameters measured during fall 2003 as part of a mercury assessment at MRR (Stillwater Sciences 2004c).

Parameter	River Channel Sites (throughout the DTR)			Floodplain (dredger tailings) Swales (MRR)		
	Ratzlaff (RM 40)	Below Hwy 59 (RM 41)	Merced River Ranch (RM 50)	Pond 1 (P1)	Pond 2 (P2)	Pond 3 (P3)
Temp (°C)	13.2	17.4	13.3	14.5	14.5	14.5
TSS (mg/L)	3.5	55	2	710	360	72
pH	7.6	7.4	7.9	7.5	7.6	7.5
DO (mg/L)	7.6	7.8	7.9	1	<0.5	<0.5
NH_4^+ (mg/L as N)	<0.003	<0.003	<0.003	0.071	<0.003	0.01
NO_2^-/NO_3^- (mg/L as N)	0.078	0.002	0.103	0.004	<0.001	0.002

Parameter	River Channel Sites (throughout the DTR)			Floodplain (dredger tailings) Swales (MRR)		
	Ratzlaff (RM 40)	Below Hwy 59 (RM 41)	Merced River Ranch (RM 50)	Pond 1 (P1)	Pond 2 (P2)	Pond 3 (P3)
SO_4^{2-} (mg/L)	1.27	0.91	1.2	0.6	0.49	0.28
TOC (mg/L)	ND	4.46	2.31	6.37	6.42	7.6
DOC (mg/L)	4.34	4.1	1.97	4.75	4.23	5.66
THg (ng/l)	1	6.5	1.1	28.4	169.2	3.2
MeHg (ng/l)	<0.03	0.44	0.04	1.1	3.01	0.15

4.2.2 Criteria for Determining Significance

The Regional Water Quality Control Board and the California Department of Health Services regulate water quality levels and maximum contaminant levels for primary drinking water supplies. State water quality standards are more stringent than the federal standards. The following potential impacts have been identified as part of the proposed project:

- exceedance of state water quality objectives for any given parameters;
- discharge of oils, grease, or any other material that would result in a film on the water or objects in the water;
- alteration of the suspended sediment load and suspended sediment discharge rate that causes a nuisance or adversely affects beneficial uses;
- alteration of surface water temperatures unless demonstrated to the Regional Water Quality Control Board that no impacts to beneficial uses would occur; and,
- changes in turbidity that cause a nuisance or adversely affect beneficial uses.

4.2.3 Environmental Consequences

4.2.3.1 No Action Alternative

Without the proposed project and under the existing conditions, there would be no changes to existing water quality. There is no evidence that the current water quality conditions have adverse effects on spawning and rearing salmonids. However, improvements to water quality are expected as part of the results of the proposed project.

4.2.3.2 Proposed Project

The proposed project has the potential to have an effect on water quality in the project area. Chemical constituents will be limited to those present at the site, and previous studies have documented low levels of chemical constituents (Stillwater Sciences 2004c). The dissolved oxygen levels will not be reduced below levels specified in the water quality objectives (CRWQCB 1998). Restoration activities will result in elevated dissolved oxygen, as turbulence and temperature amelioration contribute to improve water quality. Improved water quality is

among the overall project objectives at MRR. Any floating material or sediment mobilized during construction activity will be caught by sediment fencing along the river corridor to prevent water quality impacts. Oil and grease used in equipment will be vegetable based, or another material that does not affect beneficial uses. The pH will not be changed, and no pesticides will be used or mobilized during project activities. Salinity and radioactivity will not be changed due to project activities. Temperature conditions will not be elevated during construction activities; however temperature may be improved (reduced) by the completed project. Water temperature has been found to be improved in those areas with gravel augmentation or other types of floodplain and habitat restoration.

Mitigation Measure 4. The project will comply with Section 401 of the Clean Water Act and obtain certification for project-related activities to control sediment and maintain water quality downstream of the project site during the construction activities. To minimize risk from additional fine sediments, all trucks and equipment will be cleaned, gravels will be processed away from flowing water, and in-stream work will occur during the low flow season (e.g., < 300 cfs). Sediment fencing will be used along the river corridor to capture floating materials or sediments mobilized during construction activities, and prevent water quality impacts. Stream bank impacts will be isolated and minimized to reduce bank sloughing. The banks will be stabilized with revegetation following project activities.

4.3 Climate/Air Quality

4.3.1 Affected Environment

The proposed project is within the San Joaquin Valley Air Basin. The San Joaquin Valley Unified Air Pollution Control District is responsible for monitoring air quality in Merced County. The San Joaquin Valley's air quality has been designated nonattainment by the EPA and by the Air Resources Board for O_3 (ozone) and PM-10 (fine particulate matter, dust). The Federal Clean Air Act and the California Clean Air Act require areas that are designated nonattainment to reduce emissions until standards are met. The San Joaquin Valley Unified Air Pollution Control District monitors air quality in the county. Air quality is affected by a combination of air contaminants, meteorological conditions and the topographical configuration of the valley. A primary factor responsible for the increase of air pollution is the increased amounts of pollutants and particulate matter produced by vehicles, industrial processes, mining operations, and agricultural activities, such as burning and ground disturbance. No sensitive receptors, defined as residential and other areas where young, elderly, or infirm people would be present, are in the project vicinity.

4.3.2 Criteria for Determining Significance

The San Joaquin Valley Unified Air Pollution District has established criteria for determining local air basin impact significance. For the purpose of determining significance, the District's criteria for emissions from both nitrogen oxides (NOx) and/or reactive organic gases (ROG) is 10 tons per year. For PM-10 emissions, projects that comply with the Districts Regulation VIII are considered to have a less than significant impact. The purpose of Regulation VIII is to reduce the amount of fine particulate matter (PM-10) entrained into the ambient air from man-made sources. Project emissions that exceed the threshold limits set forth by the District are considered significant and require mitigation. Additionally, exposure of sensitive receptors to substantial pollutant concentrations would be considered a significant impact.

4.3.3 Environmental Consequences

4.3.3.1 No Action Alternative

Without the proposed project and under existing conditions, the air quality for the area would not be affected except for actions that take place under existing conditions.

4.3.3.2 Proposed Project

The proposed project, without mitigation, would have effects on air quality in the area, including the generation of dust and small particulates from the excavation and transportation of material from the floodplain, processing of materials, and operation of heavy equipment. Construction activities may potentially result in localized, short-term construction emissions. Emissions may include hydrocarbons, nitrogen oxides, sulfur oxides, carbon monoxide, and particulate matter. However, effects may have little impact as the area is rather remote, with very few residences nearby and the majority of property in rural use. Construction activities are temporary, so any changes in air quality due to the project will be limited in duration. The project does not create odors affecting a substantial number of people. Fugitive dust may be emitted during use of earth working equipment. Equipment used during construction is summarized in Table 3.

Table 3. Construction equipment number and total estimated use in the MRR floodplain restoration (annually).

Type of Equipment	Number of Each Type	Estimated Total Use (days)	Estimated Total Use (hours)
3- to 5-yd capacity, rubber-tired Front-End Loader	3 – 4	20 – 30	200 – 300
Pickup Truck	1 – 2	20 – 30	200 – 300
Portable Screen Plant	1	20 – 30	200 – 300
Tractor trailer and End-Dump Hauler	3 – 4	20 – 30	200 – 300
30-hp Trailer Mounted Pump	1 – 2	20 – 30	200 – 300
Water Truck	1 – 2	20 – 30	200 – 300

To avoid all possible impacts, we will undertake the following mitigation measures during the movement of processed material from the plant (construction staging area) to the river:

Mitigation Measure 5. Implement the following dust reduction measures during movement of materials from construction staging area to sites where gravel augmentation will occur to reduce construction-related emissions:

- wet materials to limit visible dust emissions using water;
- provide at least 6 in (15.2 cm) of freeboard space from the top of the container; or,
- cover the container.

Mitigation Measure 6. Implement the following dust reduction measure during gravel placement to reduce construction-related emissions:

- limit or promptly remove any of mud or dirt on construction equipment and vehicles at the end of each workday, or once every 24 hours.

4.4 Biological Resources

The project area was extensively mined and large piles of dredger tailings are the most prominent feature of the landscape. Currently, the entire project area consists of a remnant floodplain shelf and large piles of dredger tailings. The area is considered significantly disturbed in terms of biological resources. The Merced River corridor restoration plan identifies biological resources in the project area, and the lower Merced River (Stillwater Sciences 2002). Ongoing juvenile salmonid out-migration monitoring is conducted by AFRP and MID. The potential presence of special-status species or other special habitats in the project area was investigated with a literature search of the planning documents for the proposed project as well as field observations during preliminary investigations. The Merced River is home to several species listed by the state and federal agencies as threatened, endangered, or a species of concern (CDFG 2001; USFWS 2001; Stillwater Sciences 2002). Table 4 lists the special status species that occur in the proposed project area and may be affected by restoration activities. This list includes spring and winter-run Chinook salmon listed in the USFWS Sacramento Endangered Species Program database (http://www.fws.gov/sacramento/es/default.htm) when searching in the Snelling quadrant. While spring and winter-run Chinook salmon occur on this list they do not include the San Joaquin River or tributaries as habitat in their respective NOAA Evolutionary Significant Unit (ESU) determinations (http://www.nwr.noaa.gov/ESA-Salmon-Listings/) and as defined in Federal Register 50 CFR Parts 222 and 226 (NOAA 1994 and 2005). These species are not listed for the Snelling quadrant in the CDFG California Natural Diversity Database (CNDDB; http://www.dfg.ca.gov/biogeodata/cnddb/). Spring and winter-run Chinook salmon have been extirpated from the San Joaquin Basin; therefore, we assume there will be no adverse impacts to these ESUs.

Table 4. Special status species that may occur in the proposed project area. Data compiled from the CNDDB and USFWS database by searching the Snelling quadrant (December 2009).

Scientific Name	Common Name	Federal Status	State Status
Castilleja campestris ssp. succulenta	Succulent owl's clover	Threatened	Endangered
Chamaesyce hooveri	Hoover's spurge	None*	None
Neostapfia colusana	Colusa grass	None*	Endangered
Orcuttia californica	San Joaquin Valley Orcutt grass	None*	Endangered
Orcuttia pilosa	Hairy Orcutt grass	None*	Endangered
Pseudobahia bahiifolia	Hartweg's golden sunburst	Endangered	Endangered
Tuctoria greenei	Greene's tuctoria	None*	Rare
Branchinecta conservatio	Conservancy fairy shrimp	Endangered	None
Branchinecta lynchi	Vernal pool fairy shrimp	Threatened	None
Lepidurus packardi	Vernal pool tadpole shrimp	Endangered	None
Desmocerus californicus dimorphus	Valley elderberry longhorn beetle	Threatened	None
Hypomesus transpacificus	Delta smelt	Threatened	None

Scientific Name	Common Name	Federal Status	State Status
Oncorhynchus tshawytscha	Fall/late fall-run Chinook salmon	None	CDFG species of special concern
Oncorhynchus tshawytscha	Spring-run Chinook salmon	Threatened	Threatened
Oncorhynchus tshawytscha	Winter-run Chinook salmon	Endangered	Endangered
Oncorhynchus mykiss	Central Valley steelhead	Threatened	None
Lampetra hubbsi	Kern brook lamprey	None	CDFG species of special concern
Mylopharodon conocephalus	Hardhead	None	CDFG species of special concern
Ambystoma californiense	California tiger salamander	Threatened	Candidate Threatened
Rana aurora draytonii	California red-legged frog	Threatened	CDFG species of special concern
Spea hammondii	Western spadefoot	None	CDFG species of special concern
Clemmys marmorata	Western pond turtle	None	CDFG species of special concern
Elanus leucurus	White-tailed kite	None	CDFG fully protected
Haliaeetus leucocephalus	Bald eagle (nesting & nonbreeding/wintering)	Delisted	Endangered, CDFG fully protected
Pandion haliaetus	Osprey (nesting)	None	None
Circus cyaneus	Northern harrier	None	CDFG species of special concern
Accipiter cooperii	Cooper's hawk	None	CDFG species of special concern
Accipiter striatus	Sharp-shinned hawk	None	CDFG species of special concern
Falco mexicanus	Prairie falcon (nesting)	None	CDFG species of special concern
Buteo swainsoni	Swainson's hawk	None	Threatened
Icteria virens	Yellow-breasted chat (nesting)	None	CDFG species of special concern
Agelaius tricolor	Tricolored blackbird (nesting colony)	None	CDFG species of special concern
Lasiurus blossevilli	Western red bat	None	CDFG species of special concern
Antrozous pallidus	Pallid bat	None	CDFG species of special concern
Taxidea taxus	American badger	None	CDFG species of special concern
Vulpes macrotis mutica	San Joaquin kit fox	Endangered	Threatened

**Indicates the project site is within federal Critical Habitat for the species.*

The only potentially adverse impacts to biological resources from the project would be those associated with gravel excavation, processing, movement from staging area to river, and river placement, Gravel will be processed (sorted) onsite and placed at specific sites in the adjacent Merced River to augment natural gravel recruitment processes; no gravel will be transported

offsite. The following measures will reduce any such potentially significant impacts to less than significant.

Mitigation Measure 7. Each year, before beginning construction activities a pre-project survey will be conducted of the project site. Extensive surveys for elderberry shrubs have already been completed (URS 2006d), and areas to avoid identified. If elderberry shrubs (or other special status plants) are identified in subsequent surveys they will be avoided. Complete avoidance may be assumed when there is at least a 100-ft (30.5 m) buffer around the plant. These buffers will be established and maintained around all elderberry plants with stems measuring 1 in (2.5 cm) in diameter at the ground level (USFWS 1999). Project activities will be adjusted to ensure no activities occur in the buffer area, thereby avoiding any negative effects on valley elderberry longhorn beetle.

Mitigation Measure 8. Table 5 lists the critical periods when disturbance could result in significant impacts to individuals or populations of special status species. To avoid these impacts, all project ground disturbing activities will be conducted during the period August through September, which is outside the listed critical periods (Table 5). If work must be conducted before this time, appropriate surveys would be performed to avoid impacts to special status and sensitive species. Nesting birds and raptors are protected under the MBTA and California Fish and Game Code. Trees and shrubs within the project area likely provide nesting habitat for songbirds and raptors. If tree removal is unavoidable, it will occur during the non-breeding season (mid-September). If other construction activities must occur during the potential breeding season (February through mid-September) surveys for active nests and/or roosts will be conducted by a qualified biologist no more than 30 days prior to the start of construction. A minimum no disturbance buffer will be delineated around active nests (note, size of buffer depends on species encountered) until the breeding season has ended or until a qualified biologist has determined that the birds have fledged and are no longer reliant upon the nest or parental care for survival.

Mitigation Measure 9. For bat species, before any ground disturbing activities, a qualified biologist will survey for the presence of associated habitat types for the bat species of concern. If bats are present, suitable avoidance and conservation measures will be implemented: project will avoid work in May, June, and July and will apply a minimum 300 ft (91.4 m) buffer of roosting bats, maternity roosts or winter hibernacula until all young bats have fledged.

Mitigation Measure 10. Pre-construction surveys will be conducted by qualified wildlife biologists, who will determine the use of the project site by American badgers; surveys will focus on identification of potential badger dens within the construction footprint and a minimum 250 ft (76.2 m) buffer around the construction footprint. If badger dens are located within the construction or buffer area, prior to initiation of construction CDFG will be consulted for further instructions on methods to avoid direct impacts to this species. Pre-construction surveys will also be conducted by qualified wildlife biologists to determine the use of the project site and a minimum 500 ft (152.4 m) buffer around the construction footprint by San Joaquin kit fox; surveys will focus on identification of potential, atypical, active, and natal (USFWS 1999b) kit fox dens. If potential kit fox dens are located within the construction or buffer area, a minimum of five consecutive nights of camera/scent stations and track stations will be placed by the den entrances in order to determine if the den is in use by kit fox. If active or natal dens are confirmed, CDFG and USFWS will be consulted for further instructions on methods to avoid direct impacts to this species as well as the need for incidental take permits.

Mitigation Measure 11. Special transportation routes and work areas will be designated to avoid damaging trees and shrubs in riparian habitats, especially those sensitive species described above.

Potential impacts to the riparian vegetation could occur during the transport of gravel from construction staging area to the river. These impacts will be minimized to the greatest extent practicable by selecting routes that avoid or minimize damage. There will be no impacts on heritage size trees (i.e., greater than 16 in [40.6 cm] in diameter). Trees will be flagged and fenced (when near work area) to prevent unintended damage.

Table 5. Critical periods for special status species that may be affected by the construction activities.

Common Name	Critical Period
Fall-run Chinook Salmon	October through June
Central Valley Steelhead	December through May
Pacific Lamprey	March through June
Western Spadefoot	October through July
Western Pond Turtle	March through July
Bald Eagle	November through July
Osprey	March through July
Swainson's Hawk	March through August
Bats *Myotis* spp.	May through July

4.4.1 Vegetation

4.4.1.1 Affected Environment

The Merced River and its floodplain historically supported dense riparian woodland. While much of the Central Valley upland and foothills were historically covered by sparsely wooded grasslands, pre-settlement riparian zones supported dense, multistoried stands of broadleaf trees, including valley oak *Quercus lobata*, Fremont cottonwood, western sycamore *Platanus racemosa*, willow, Oregon ash *Fraxinus latifolia*, box elder *Acer negundo*, California black walnut *Juglans californica* and other species (Thompson 1961, 1980; Roberts et al. 1980; Conard et al. 1980; Holland and Keil 1995). These riparian forests varied greatly in width, from a narrow strip in confined reaches to several miles wide on broad alluvial floodplains (Thompson 1961). Local accounts of the Merced River describe the rich aquatic and terrestrial fauna supported by riparian habitats (Edminster 1998).

4.4.1.1.1 Special Status Plants

Special-status plant species are defined as vascular plants that are: 1) designated as rare, threatened, or endangered by the state or federal governments; 2) proposed for rare, threatened, or endangered status; or, 3) state or federal candidate species.

Succulent Owl's Clover *Castilleja campestris ssp. succulenta*

Succulent owl's-clover, also known as fleshy owl's-clover, is an annual herb in the snapdragon family (Scrophulariaceae). Its stems are erect, generally 2 – 10 inches (5 – 25.4 cm) tall, and may be branched or unbranched. The leaves are succulent and brittle. Bright yellow to white flowers appear in May, clustered near the ends of branches and surrounded by leafy bracts. Like other members of Castilleja and related genera, it is partly parasitic (hemiparasitic) on the roots of other plants. It occurs on the margins of vernal pools, swales and some seasonal wetlands, often on acidic soils. It is never dominant and it is found in only a few of the pools in an area. Succulent

owl's-clover is found only in vernal pools along the rolling lower foothills and valleys along the eastern San Joaquin Valley in the Southern Sierra Foothills Vernal Pool Region. Through August 2005, the CNDDB had catalogued 91 occurrences. About one third of these occurrences are records from Merced County, catalogued in association with rare plant and wildlife surveys of eastern Merced County grass and ranch lands conducted during 2001 by a team of consultants to the County and California Department of Fish and Game (Vollmar 2002).

According to the USFWS, habitat loss and fragmentation are the largest threats to the survival and recovery of vernal pool species. Loss of habitat generally results from urbanization, agricultural conversion and mining. Habitat loss also occurs in the form of habitat alteration and degradation as a result of changes to natural hydrology, invasive species, incompatible grazing regimes, infrastructure projects (e.g., roads, water storage and conveyance, utilities), recreational activities (e.g., off-highway vehicles and hiking), erosion, contamination and inadequate management and monitoring. The MRR project site is highly impacted from historical grazing and mining practices. The entire project footprint is located on dredger tailings which contain none of the soil properties needed to sustain vernal pools or their plant communities. No observations of vernal pool habitat or succulent owl's clover have been observed at the site. This species is not likely to be present at the project site.

Hoover's Spurge *Chamaesyce hooveri*

Hoover's spurge, also known as Hoover's sanmat, is a prostrate, tap-rooted, annual herb in the spurge family (Euphorbiaceae). It forms mats from a few inches to a few feet across. The flowering structure is a small, highly simplified cup-like "cyathium," as in all other spurges (Chamaesyce and Euphorbia). The flowering structure in Hoover's spurge has petal-like glands that are red to olive in color. Blooms appear in July. This species is readily distinguished from other species of Chamaesyce by characteristics of growth habit, plant color and leaf shape. It is distinguished from plants in the genus Euphorbia on the basis of growth habit, vascular anatomy, and photosynthetic pathway. Hoover's spurge grows in relatively large, deep vernal pools among the rolling hills, remnant alluvial fans and depositional stream terraces at the base of the Sierra Nevada foothills. It tends to occur where competition from other species has been reduced by prolonged seasonal inundation or other factors. The main remaining area of concentration for Hoover's spurge is in the northeastern Sacramento Valley. The Vina Plains of Tehama and Butte counties contains most of the known extant occurrences. Another concentration is in the Southern Sierra Foothills, including the Visalia-Yettem area of Tulare County and the Hickman-La Grange area of Stanislaus County. Three other occurrences are on the Sacramento National Wildlife Refuge in Glenn County. Habitat loss and fragmentation are the largest threats to the survival and recovery of vernal pool species. Loss of habitat generally results from urbanization, agricultural conversion and mining. Habitat loss also occurs in the form of habitat alteration and degradation as a result of changes to natural hydrology, invasive species, incompatible grazing regimes, infrastructure projects (e.g., roads, water storage and conveyance, utilities), recreational activities (e.g., off-highway vehicles and hiking), erosion, contamination and inadequate management and monitoring. Agricultural conversions are a continuing specific threat, particularly in Stanislaus County. Competition from invasive native and non-native plants threatens nine of the extant occurrences, including eight in the Vina Plains and one on the Sacramento National Wildlife Refuge in Glenn County. Five of the remaining occurrences are subject to specific hydrological threats. Some specific threats also are continuing due to inappropriate livestock grazing practices. Because of specific habitat requirements of this plant and the highly degraded habitat associated with the MRR, this species is not likely to be present in project area.

Colusa Grass *Neostapfia colusana*

Colusa grass is always found in vernal pool or vernally flooded habitat. This species historically occurred throughout the Great Central Valley, but is now known from only Colusa, Merced, Solano, and Stanislaus counties (Hickman 1993). The MRR does not contain any known occurrences of Colusa grass near the project area, but this plant is known to occur in various locations throughout Merced County. Focused surveys for this species did not locate any individuals within the project area. This species is not likely to be present in within the project site.

San Joaquin Valley Orcutt Grass *Orcuttia californica*

San Joaquin Valley Orcutt grass is a California endemic, and is a Federally Threatened, State Endangered species. It is ranked by CNPS as very rare. This species is closely associated with vernal pools and moist places below 656 ft (200 m) in elevation. This is currently known to occur in Fresno, Madera, Merced, Stanislaus, and Tulare counties (Hickman 1993). The CNDDB contains no records documenting the presence of this species in the project area. Focused surveys for this species did not locate any individuals within the project area. This species is not likely to be present in the project area.

Hairy Orcutt Grass *Orcuttia pilosa*

Hairy Orcutt grass, also called pilose Orcutt grass, is endemic to the Sacramento Valley (CNDDB). This is a Federal and State Endangered species, and is ranked by the California Native Plant Society (CNPS) as very rare. This species is closely associated with vernal pools and moist places from 82 – 410 ft (25 – 125 m) in elevation (CNDDB). This species is currently known to occur in Madera, Merced, Stanislaus, and Tehama counties (Hickman 1993). The CNDDB lists one occurrence of hairy Orcutt grass near the project area. This occurrence is located 3.2 miles south of Snelling, on the west side of Snelling road. The initial occurrence was made from a herbarium specimen collected in 1957. The plant was described as common at the time of collection. A return visit to the site in 1986 did not locate any hairy Orcutt grass, but the habitat was found to be suitable. Because this plant species is dependent upon short grass vernal pool landscapes, it is unlikely that this species occurs within the project area. Focused surveys for this species did not locate any individuals within the project area. This species is not likely to be present in project area.

Hartweg's Golden Sunburst *Pseudobahia bahiifolia*

Hartweg's golden sunburst, also called Hartweg's pseudobahia, is a slender, woolly annual in the sunflower family (Asteraceae). It has one or a few stems 2 – 6 in (5 – 15.2 cm) tall, with mostly narrow, undivided leaves. The yellow, or "golden," flowers bloom in March and April. A member of the sneezeweed tribe (Helenieae), the Pseudobahia genus is distinguished from related genera by characteristics of the leaves, flowers, and seeds. Hartweg's golden sunburst is distinguished from other members of the genus by the shape of its largest leaves, which are entire or three-lobed. Hartweg's golden sunburst occurs in open grasslands and grasslands at the margins of blue oak woodland, primarily on shallow, well-drained, fine-textured soils, nearly always on the north or northeast facing of “mima mounds”. These are mounds of earth, of unknown origin, roughly 1 – 6 ft (30 – 182.8 cm) high and 10 – 100 ft (3 – 30.5 m) in diameter at the base, interspersed with basins that may pond water in the rainy season. The species is found only in the Central Valley of California. Historically, the range of the species may have extended from Yuba County south to Fresno County, a range of 200 mi (321.9 km). Within this range, the species was only locally abundant. Today, there are 16 populations on the eastern edge of the San Joaquin Valley. Remaining populations are concentrated in the Friant region of Fresno and

Madera counties and the La Grange region in Stanislaus County. According to the USFWS, Hartweg's golden sunburst has declined because of habitat loss caused by agricultural and urban development, levee construction, pumice mining, cattle grazing, and competition with nonnative weeds, road widening and off-road vehicle use. One population is protected under a conservation agreement between The Nature Conservancy and the U.S. Bureau of Reclamation. The remaining populations continue to be threatened by some or all of the above activities. Due to extensive dredge mining activity and lack of mima mounds within the project area, this species is not likely to be present in within the project site.

Greene's Tuctoria *Tuctoria greenei*

Greene's tuctoria, which is also known as Greene's Orcutt grass or awnless spiralgrass, is a small, tufted annual in the grass family (Poaceae). The plant has several to many stems 2 – 6 in (5.1 – 15.2 cm) tall, each ending in a spike-like inflorescence that may be partly enfolded in the upper leaf. The lemmas (bracts) are strongly curved and more or less truncate at the apex (Hickman 1993). Greene's tuctoria is currently found in widely separated occurrences in Butte, Merced, Shasta, and Tehama counties. Sixty percent of the extant occurrences are in the Vina Plains area of Tehama and Butte counties. Eastern Merced County has about 30% of the known occurrences. Other occurrences are located in Glenn and Shasta counties. The species has been extirpated from Fresno, Madera, San Joaquin, Stanislaus and Tulare counties.

4.4.1.2 Criteria for Determining Significance

Impacts to botanical resources would be considered significant if they result in one of the following criteria:

- direct mortality of state or federally-listed plant species;
- indirect reductions in the size of a special status plants species population; and,
- potential to reduce the extent or values of habitats in which special-status plant populations occur.

4.4.1.3 Environmental Consequences

4.4.1.3.1 No Action Alternative

Under the No-Action Alternative, there would be no project related impacts to riparian vegetation or existing special status plant species.

4.4.1.3.2 Proposed Project

To avoid and/or minimize any impacts to state and federally listed plant species and existing critical habitat, the project site would be surveyed for sensitive plant species prior to the start of any ground disturbing activities. If any are found, resource agency biologists (CDFG, USFWS) will be contacted to develop appropriate avoidance and conservation measures. Listed plants will be flagged and fenced with sufficient buffers to prevent impact. Implementing the measures would avoid adverse effects on listed species and associated habitats, and any remaining impacts would be insignificant or discountable. No impacts to upland plant species are expected to result from gravel extraction and processing activities. Exotic species present in the upland and riparian areas, which include tree of heaven, Himalayan blackberry, and yellow starthistle, will be eradicated where possible. Tree of heaven will be removed and disposed of at an approved facility. No impacts to riparian plant species are expected to result from removing gravel in the

gravel extraction and processing area or to provide access routes for heavy equipment to the rivers. Mature Fremont cottonwoods and oaks will be preserved and avoided.

4.4.2 Jurisdictional Waters of the U.S.

Under Section 404 of the Clean Water Act, the U.S. Army Corps of Engineers regulates the disposal of dredged and fill materials into "jurisdictional waters of the United States". Waters include intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, and wetlands adjacent to any water of the U.S. (CFR 33 Part 328). Navigable waters are also regulated under Section 10 of the Rivers and Harbors Act.

4.4.2.1 Affected Environment

The Merced River is a tributary to the San Joaquin River in the southern portion of California's Central Valley. The river, which drains an approximately 1,276 mi^2 (3,305 km^2) watershed, originates in Yosemite National Park and flows southwest through the Sierra Nevada range before joining the San Joaquin River 87 mi (140 km) south of the City of Sacramento. Elevations in the watershed range from 13,000 ft (4,000 m) at its crest to 49 ft (15 m) at the confluence with the San Joaquin River. The DTR of the Merced River extends from Crocker-Huffman Dam at RM 52 to approximately 1.2 mi (1.9 km) downstream of the Snelling Road Bridge at RM 45 and located within the USGS (topo) latitude - longitude coordinates of N 37.56243 and W -120.43853 Three types of potentially jurisdictional wetlands and other waters of the U.S. were identified in the study area during the wetland delineation field investigation: emergent marsh, seasonal wetlands and non-wetland waters of the U.S. A total of 21.4 acres (8.7 ha) of potential jurisdictional wetlands and 18.8 acres (7.6 ha) of potential waters of the U.S. have been delineated in the study area, for a total of 40.2 acres (16.3 ha) (URS 2006a). An approximate area of 5.5 ac (~2.2 ha) of the Merced River will have gravel augmentation to improve habitat for native fish.

4.4.2.2 Criteria for Determining Significance

Impacts to state or federal jurisdictional waters would be considered significant if they resulted in a permanent decrease in the function and value of wetland and riparian habitat within the project reach.

4.4.2.3 Environmental Consequences

4.4.2.3.1 No Action Alternative

Under a No-Action Alternative, no impacts to existing state or federal jurisdictional waters would occur.

4.4.2.3.2 Proposed Project

Gravel augmentation will occur in approximately 5.5 ac (~2.2 ha) of the Merced River to improve habitat for native fish. All non-riverine wetland habitats will be avoided and will not be impacted during the construction activities, and additional wetland habitats will be created as part of the floodplain recovery. This project will result in a net gain in wetland acreage to the area, which is expected to be seasonally inundated.

4.4.3 Wildlife

4.4.3.1 Affected Environment

The proposed project area includes remnant floodplain habitat, and heavily impacted riparian areas changed by historic mining activities. There is residual riparian and oak woodland habitat in the proposed project area.

4.4.3.1.1 Special Status Wildlife Species

Special-status wildlife species are defined as taxa that are: 1) designated as threatened or endangered by the state or federal governments; 2) proposed or petitioned for federal threatened or endangered status; 3) state or federal candidate species; 4) listed as Species of Concern by the USFWS; or, 5) identified by the CDFG as Species of Special Concern. The special-status wildlife species that may potentially occur in the project area are described below. Pre-construction surveys will be conducted for these species and if any are found, USFWS and CDFG biologists will be consulted about avoidance and conservation measures.

Invertebrates

Conservancy Fairy Shrimp *Branchinecta conservatio*

The conservancy fairy shrimp, an anostracan, is found in cool water ponds with low to moderate amounts of dissolved solids. Pools containing conservancy fairy shrimp are seasonally astatic, filled by winter and spring rains, and usually last into June at the latest (Eriksen and Belk 1999). *B. conservatio* has been collected November-April, when temperatures are 5°C – 24°C. Hatching occurs about a week after pool filling at 10°C, and at least 19 days are required to reach maturity if water temperatures slowly increase to 20°C.

Individual *B. conservatio* may live up to 154 days. Only one cohort is produced each year, so both sexes usually disappear long before their native pools are dry. Cysts are produced in large numbers, and are relatively small (mean diameter of 0.23 mm) compared to other California fairy shrimp (Eriksen and Belk 1999). Conservancy fairy shrimp are found in grasslands in the northern two-thirds of the Central Valley, at elevations of 16 – 476 ft (4.9 – 145 m). Within this area, populations are even more restricted and occur in just a few fragmented localities. This limited range is within land forms that are prime areas for agriculture and urban development, which constitute the largest threat to this species (Eriksen and Belk 1999). The conservancy fairy shrimp is a federally listed endangered species.

The CNDDB shows no known occurrences of conservancy fairy shrimp in or near the project area. This species is dependent upon short grass vernal pool landscapes, so it may occur in nearby grasslands but not within or directly adjacent to the project area. While the land adjacent to the Merced River riparian corridor may have historically supported vernal pools, intensive gold and gravel mining and agriculture has replaced this habitat type in the project area vicinity. The non-native grassland located on the southern side of the Robinson reach is intensively grazed, and has been repeatedly disked. This species does not occur in any of the project site.

Vernal Pool Fairy Shrimp *Branchinecta lynchi*

The vernal pool fairy shrimp is a short-lived anostracan, found in cool temporary ponds with low to moderate dissolved solids. Vernal pool fairy shrimp have a wide distribution throughout California's grasslands, but are usually outnumbered by other fairy shrimp species when they co-occur. Distribution ranges from near Red Bluff in Shasta County south through most of the Central Valley continuing, via disjoint populations, south to Riverside County. Locations of

vernal pool fairy shrimp typically exist from 33 – 951 ft (10.1 – 289.9 m) in elevation although, in the South Coast Mountain region, some populations are found at elevations as high as 3,803 ft (1,159.2 m). Populations exist in small depressions in sandstone outcrops less than one meter wide; or small swales, earth slumps, in basalt flow depressions with grassy or muddy bottoms; or in unplowed grasslands. These pools are smaller than those inhabited by most fairy shrimp, except the mid-valley shrimp (Eriksen and Belk 1999). These are predominantly the California vernal pools discussed by Holland (1978). Vernal pool fairy shrimp appear early December to early May, in pools filled by winter and spring rains. Temperatures of these pools while inhabited range between 4.5°C – 23°C, with low to moderate Total Dissolved Solids (48 – 481 ppm, mean of 185 ppm), moderate alkalinity (22 – 274 ppm, average of 91 ppm), and a mean pH of 6.8 (range 6.3 – 8.5). The extensive range of the vernal pool fairy shrimp occurs mainly within landforms that are prime areas for agricultural and urban development, which constitute the largest threat to this species (Eriksen and Belk, 1999). Vernal pool fairy shrimp are a federally listed threatened species. The CNDDB lists two known occurrences of vernal pool fairy shrimp near the project area. One location, in 1999, is east of J59, adjacent to a landfill seven miles NNW of Merced. The second location is southwest of Yosemite Lake, approximately four miles north of Merced. Because this species is dependent upon short grass vernal pool landscapes, it is unlikely that this species occurs within the project area. While the land adjacent to the Merced River riparian corridor may have historically supported vernal pools, dredge mining and intensive agriculture has replaced this habitat type in the project area vicinity.

Vernal Pool Tadpole Shrimp *Lepidurus packardi*

Vernal pool tadpole shrimp are poorly understood notostracans, characterized by their few, similarly-sized median spines on their supra-anal plate, which are not placed on a keel, and their 35 pairs of legs (Pennack 1989). Vernal pool tadpole shrimp are typically found in temporary ponds and swales containing clear to highly turbid water. Pools containing vernal pool tadpole shrimp are commonly found in unplowed grasslands (CNDDB). Currently, vernal pool tadpole shrimp exist in vernal pools ranging from the north end of the Central Valley around Redding to the south Central Valley around Visalia, between the Coast Range and the Sierra Nevada. Within this range, distribution is patchy and generally clustered into vernal pool complexes.

Vernal pool tadpole shrimp appear in pools filled by fall and winter rains, re-establishing each year from diapaused (resting) cysts (King 1996). Virtually all pools inhabited by the vernal pool tadpole shrimp fill, even during drought years (King 1996). The patchy distribution of the vernal pool tadpole shrimp occurs on flat, developable land that has easy accessibility (Cheatham, 1976). As a result, habitat loss constitutes the largest threat to this species. Because this species is dependent upon short grass vernal pool landscapes, it is unlikely that this species occurs within the project area. While the land adjacent to the Merced River riparian corridor may have historically supported vernal pools, dredge mining and intensive agriculture has replaced this habitat type in the project area vicinity.

Valley Elderberry Longhorn Beetle *Desmocerus californicus dimorphus*

The Valley elderberry longhorn beetle is a medium-sized (about 0.8 in [2 cm] long) beetle, with ‘dimorphus’ sexual appearance. The male forewings are primarily red with dark green spots, while the female have dark metallic green with red margins. The entire life cycle is associated with elderberry trees *Sambucus* spp. in California’s Central Valley. In the Central Valley, elderberry trees are associated with riparian forests. The beetle historically ranged throughout the valley, but recent surveys find it persists only in limited localities along the Sacramento, American, San Joaquin, Kings, Kaweah, and Tule rivers and their tributaries. Occurrences have been documented in Fresno, Madera, Merced, Stanislaus, San Joaquin, and Tulare counties

(CDFG 2002). Kellner (1992) reported the most observations along the Merced River and further north. Current efforts to save the valley elderberry longhorn beetle have focused on revegetating riparian habitats, which will occur as part of the restoration efforts at MRR. The adult stage is short-lived in the valley elderberry longhorn beetle, and the adults are active from early March to early June; mating occurs in May (Barr 1991). Eggs are laid singly, or in groups, along the elderberry bark's crevices, and hatch in about 10 days. Larvae burrow a cavity inside the bark, roots and branches of the elderberry and pupate. Gestation for this stage is one to two years before emerging as adults (Barr 1991). They appear to prefer elderberry of certain size classes, typically larger mature plants (Kellner 1992). The USFWS Conservation Guidelines for the beetle consider plants with one or more stems (>0.98 in [2.5 cm]) to be potential host plants (USFWS 1999). Elderberry plants are present within the project footprint.

Amphibians

California Tiger Salamander *Ambystoma californiense*

California tiger salamander is a terrestrial amphibian in the family Ambystomatidae. It is large and stocky with a broad, rounded snout with small eyes protruding from their heads. They have black irises. Adult males are about 8 in (20 cm) long, females a little less than 7 in (18 cm). Coloration consists of white or pale yellow spots or bars on a black background on the back and sides. The belly varies from almost uniform white or pale yellow to a variegated pattern of white or pale yellow and black. California tiger salamanders are restricted to breeding in vernal pools and seasonal ponds, including many constructed stock ponds, in grassland and oak savannah plant communities, predominantly from sea level to 2,000 ft (609.6 m), in central California. Larvae require significantly more time to transform into juvenile adults than other native amphibians. They are relatively poor burrowers, requiring refuges provided by ground squirrels and other burrowing mammals in which they live underground during dry months. The primary cause of California tiger salamander decline is the loss and fragmentation of habitat from urban and agricultural development, land conversion, and other human-caused factors. California tiger salamanders require large contiguous areas of vernal pools (vernal pool complexes or comparable aquatic breeding habitat) containing multiple breeding ponds to ensure recolonization of individual ponds, in association with extensive upland areas. A strong negative association between bullfrogs and California tiger salamanders has been documented. Louisiana swamp crayfish, mosquito fish, green sunfish and other introduced fishes also prey on adult or larval salamanders. Other impacts to this species include disease, reduction of ground squirrel populations and direct and indirect impacts from pesticides. The introduction of various nonnative tiger salamander subspecies may out-compete California tiger salamanders, or interbreed with them to create hybrids that may be less adapted to the California climate, or are not reproductively viable past the first or second generations. Some hybrid tiger salamanders exhibit hybrid vigor. Automobiles and off-road vehicles kill a significant number of migrating California tiger salamanders, and contaminated runoff from roads, highways and agriculture may adversely affect them. Recent surveys did not document this species within MRR (Stillwater Sciences 2005), and suitable breeding and upland habitat is not present in the portion of the project area to be disturbed. Floodplain habitats recovered by project activities may provide additional habitat and benefit for this species.

California Red-legged Frog *Rana aurora draytonii*

The California red-legged frog *Rana aurora draytonii* is the largest native frog in the western United States, ranging from 1.6 – 5.1 in (4 – 13 cm) long. The abdomen and hind legs of adults are largely red. The back has small black flecks and larger irregular dark blotches. These frogs have indistinct outlines on a brown, gray, olive, or reddish background color. The spots on the

frogs' backs usually have light centers. Lateral folds are prominent on the back. They prefer quiet pools of streams, marshes, and occasionally ponds. This species occurs along the Coast Range Mountains from Mendocino County south, and in portions of the Sierra Nevada and Cascade mountain ranges. Sierra populations are highly restricted and consist of small numbers of individuals. Red-legged frogs prefer habitat in aquatic sites with substantial riparian and aquatic vegetation cover, especially those areas that lack invasive predators such as bullfrogs *Rana catesbiana*, bass *Micropterus* spp., and sunfish *Lepomis* spp. (USFWS 1996). Coastal lagoons, marshes, springs, permanent and semi-permanent natural ponds, ponded or backwater portions of streams, and artificial impoundments such as stock ponds, irrigation ponds, and siltation ponds can all be inhabited by red-legged frogs. Breeding occurs from late November to April. Frogs lay loose masses of eggs attached to the undersides of emergent vegetation near the top of the water, and eggs hatch within 6 – 14 days. Within 14 – 21 weeks tadpoles transform into frogs, and metamorphosis usually occurs in the summer months (USFWS 1997). Human activities that result in habitat destruction and/or the introduction of exotic competitors such as bullfrogs and green sunfish may have a negative effect on this species. This species is not known to occur in eastern Merced County, and has not been observed in the project area. Focused surveys will be conducted for this species, and if encountered, consultation with USFWS will occur. We do not expect that there will be an impact to this species by the construction and monitoring activities associated with the proposed project.

Western Spadefoot *Spea hammondii*

The western spadefoot toad *Spea hammondii*, ranges in size from 1.5 – 2.5 in (3.8 – 6.4 cm) in length. Their coloration can be green, brown, yellow, or gray with irregular light stripes and random darker blotches. The skin of this toad is relatively smooth with scattered small tubercles, red or orange tipped in some individuals; the coloration of the belly is whitish. The body of the spadefoot toad is plump with short limbs, the eyes are large with vertical pupils, and the eardrum is apparent. The most distinguishing characteristic of this species is the prominent sharp-edged "spade" on each hind foot. Toad larvae forage on planktonic organisms and algae, generally. Autumn rain initiates movement of the toads from their burrows to the surface. Breeding and egg laying usually occur during the late winter through March, and almost exclusively in temporary pools formed during the rain lacking aquatic vegetation. Agriculture, urban developments, and extensive grazing have degraded or eliminated breeding and upland habitat for this species. The Western spadefoot ranges along the entire Central Valley, the adjacent foothills, to the Mexican border. The CNDDB does not contain any confirmed sightings of this species in or adjacent to the project area, and at a nearby project site (i.e., Robinson Reach). Additionally general and focused biological surveys failed to detect the species in the project area (URS Greiner Woodward Clyde 2000). However, the species was encountered by Department of Water Resources (DWR) and CDFG biologists adjacent to the Robinson Reach in 2001 (Julie Vance, pers. comm.). Because the area to be disturbed is composed of coarse materials (tailings) rather than the friable soils typically utilized by this species for burrowing, and because the area to be disturbed is not adjacent to ephemeral wetlands typically used by this species as breeding habitat, the project likely will have a less than significant impact on this species.

Reptiles

Western Pond Turtle *Clemmys marmorata*

Western pond turtles range in size from approximately 3.5 – 7.5 in (8.9 – 19.1 cm). They have an olive, dark brown or blackish shell, and are found near ponds, marshes, rivers, streams and irrigation ditches. They prefer rocky or muddy bottoms with aquatic vegetation. Turtles forage on plants, insects, worms, fish, and carrion. The species occurs from Baja California to British

Columbia, west of the Sierra-Cascades crest. The San Joaquin Valley is within an 'intergrade' zone (Stebbins 1985). The turtles inhabit a wide range of areas including ponds, lakes, slow-moving streams, or ditches. The known elevational range of the western pond turtle extends from near sea level to approximately 4,690 ft (1,430 m). Hatchlings and juveniles require very specific habitat in the first few years: low flow regions and backwater areas of rivers. Habitats preferred by juveniles are relatively scarce and subject to disturbance (Jennings et al. 1992). Adults are habitat generalists, but prefer abundant woody debris, overhanging vegetation, and rock outcroppings for basking. According to Holland (1994) mating has been observed in the field in mid-June in southern California and in captive specimens in late August and early September. Oviposition occurs on land, usually above the flood plain, up to several hundred meters from water. For nesting, gravid (with eggs) females tend to seek out open areas with sparse, low vegetation (annual grasses and herbs), a low slope angle, and dry hard soil. Incubation takes about three months and overall hatching rates are about 70% (Holland 1994). In northern California, hatching occurs in the fall, and the hatchlings usually remain in the nest chamber over the winter and emerge in spring (Holland 1994). In southern and central California, some hatchlings may emerge from the nest chamber in the fall, while others over-winter in the nest chamber and emerge in spring (Holland 1994). Western pond turtles are active year round in warm areas (Jennings et al. 1992). There is potential for competitive exclusion by introduced species such as bullfrogs or largemouth bass. Habitat destruction is also noted as a reason for decline (Jennings et al. 1992). The largest threats western pond turtles face presently are the predation of hatchlings by introduced, non-native bullfrogs and the loss of habitat due to urbanization. There is potential habitat for the species in the project site, as these turtles are known to occur in the Robinson and Ratzlaff reaches of the Merced River. Focused wildlife surveys will be conducted to document the occurrence of this species, if found, CDFG will be consulted regarding the avoidance and conservation measures to be followed.

Birds

White-tailed Kite *Elanus leucurus*

The white-tailed kite is a resident of coastal and valley lowlands west of the Sierra Nevada Mountains. The monogamous raptor breeds from February to October. Nests are built in loosely piled sticks near the tops of tree stands (Dixon et al. 1957) and a single clutch may contain 4 – 8 eggs. The species preys on small mammals, and other birds, insects and reptiles. They are solitary hunters (Ehrlich et al. 1988), but may roost communally. Essential habitats include herbaceous lowlands with limited tree growth, and dense tree groves for perching and nesting. Urbanization of agricultural lands may have contributed to the decline of the white-tailed kite (Small 1994; Stillwater Sciences 2005). White-tailed kites nest along the Merced River and have been documented in the nearby Robinson Reach. Project area wildlife surveys performed before construction activities will determine if there are nesting sites on or nearby the site. If nesting white-tailed kite is confirmed, the no-disturbance buffer should be a minimum of 0.25 mi (0.40 km) around the nest. If nests are located, we will contact CDFG to discuss implementation changes and/or additional avoidance measures.

Bald Eagle *Haliaeetus leucocephalus*

The bald eagle is a large accipiter with a brown body and white head and tail. Adults can have wingspans up to 7.5 ft (2.3 m) and average ~6.8 lb (~3.1 kg) in weight. Historically, bald eagles were found throughout North America, from Alaska and northern Canada to Baja California and the Gulf of Mexico. Currently, most populations are limited to the northern portion of their historic range. The bald eagle can live anywhere in North America with adequate nesting sites and open water (Harris 2002). Bald eagles require large bodies of water or free-flowing rivers

with abundant fish and adjacent snags or other perches. Bald eagles are primarily piscivorous, but will consume other birds, mammals, and carrion (Harris 2002; Ehrlich et al. 1988). Breeding takes place in February to July. Females have an average clutch size of two eggs and hatching is in 34 – 36 days (Ehrlich et al. 1988). Bald eagles return to the same nest site year after year. Nests are stick-built and may reach ~10 ft (3 m) in diameter and weigh up to one ton (Del Hoyo et al. 1994). Nests are built in areas with large, old growth, or dominant live trees with open branches usually located near a permanent water source. The species once numbered as many as 50,000 in the continental U.S., but by 1972, abundance had declined to around 800 pairs. Currently, bald eagles are only abundant in Alaska and Canada, and about 3,000 breeding pairs are present in the continental U.S. (Harris 2002). The bald eagle is a common winter migrant in northern California with large concentrations in the Klamath Basin (Zeiner et al. 1990). Bald eagles are known to forage along the Merced River, and have been reported in Snelling, CA. No impacts are expected due to project activities because all construction activities will occur outside of the nesting and nonbreeding/wintering seasons, and no large trees suitable for nesting will be disturbed with project activities. Bald eagle activity will be assessed during the wildlife survey.

Osprey *Pandion haliaetus*

The osprey is a large bird of prey in the Accipiter family. Adults range from 21.7 – 22.8 in (55 – 58 cm) in length and 2.6 – 4.4 lb (1.2 – 2.0 kg) in weight. Wingspans range from 57.1 – 66.9 in (145 – 170 cm) (Kirschbaum and Watkins 2000). On average, female ospreys weigh 20% more than males and have a 5% – 10% greater wingspan (Poole 1994). Individuals have a dark stripe through each eye, a dark brown back, and a white underside with dark brown patches at the carpal joints (Poole 1989; Poole 1994). The osprey has a worldwide distribution, with four sub-species that winter or breed on every continent except Antarctica. Of the four sub-species, *Pandion haliaetus carolinensis* is the only sub-species common in North America. The sub-species winters in South America and can be found breeding throughout North American and the Caribbean (Kirschbaum and Watkins 2000). Ospreys are able to survive anywhere with adequate nesting sites and abundant fish. Nest sites are typically within 1.9 – 3.1 mi (3 – 5 km) of water and are commonly found near marshes, swamps, lakes, or rivers (Poole 1989; Poole 1994). In North America, Ospreys are migratory and typically begin breeding in April or May (Poole 1989). Females lay an average of three eggs per year. Hatching is in 32 – 43 days (Kirschbaum and Watkins 2000). Home range size varies from 2,471 – 3,459 ac (10 – 14 km^2), depending on the season (Poole et al. 2002). Ospreys are almost exclusively piscivorous (Kirschbaum and Watkins 2000). Osprey are known to forage along the Merced River, and have been observed in locations surrounding the project site. No impacts are expected due to project activities because all activities will occur outside of the nesting season, and no large trees suitable for nesting will be disturbed with project activities. Osprey presence will be assessed during the wildlife survey.

Northern harrier *Circus cyaneus*

The northern harrier is an Accipiter hawk with a number of unique characteristics. Individuals have specialized feathers in the shape of a disk to focus sound into their ears, a white rump patch visible in flight, and wings that form a dihedral when gliding (Wheeler and Clark 1987). Adults range from 16.1 – 19.7 in (41 – 50 cm) in length and average ~1 lb (~450 g) in weight (Limas 2001). The northern harrier is found throughout the northern hemisphere and is known to breed from Alaska and Canada in northern North America to Baja California in southern North America. North American populations winter from southern Canada to Central America (Macwhirter and Bildstein 1996). The species prefers open habitats, such as fields, meadows, and marshes, but is also found in agricultural areas and riparian zones (Wheeler and Clark 1987; Macwhirter and Bildstein 1996). The northern harrier nests in loose colonies and breeding occurs from April through September. Nests are built on the ground on raised mounds (Limas 2001).

Home range sizes vary and average 642 ac (~2.6 km^2) (Macwhirter and Bildstein 1996). Common diet items include small mammals, birds, reptiles, and amphibians (Wheeler and Clark 1987; Macwhirter and Bildstein 1996). Wildlife surveys will be completed before project actions to determine if Northern harrier are in the area. If active nests are found, they will be flagged and CDFG will be consulted for further instructions. All construction activities will occur outside of the breeding period for these birds, and therefore we do not expect to impact the species with construction activities.

Cooper's hawk *Accipiter cooperii*

The Cooper's hawk is a medium-sized hawk with an elongated body. Individuals have a blue-gray back with a light nape and dark crown. Cooper's hawks can be distinguished from similar species by their long barred tail with a rounded tip (Dewey and Perepelyuk 2000). Adults range from 13.8 – 19.7 in (35 – 50 cm) in length and average ~1.2 lb (~525 g) in weight (Johnsgard 1990; Peterson and Peterson 2002). The Cooper's hawk is native to Nearctic and Neotropical regions and can be found wintering as far north as the northern U.S. and southern Canada and as far south as Costa Rica. The species prefers deciduous and mixed forests, but can also be found in other open woodland habitats (Johnsgard 1990; Dewey and Perepelyuk 2000). Cooper's hawks are monogamous. Breeding begins in March and occurs once each year. Females deposit 3 – 6 eggs in a stick-built nest and hatching occurs in 32 – 36 days (Dewey and Perepelyuk 2000; Peterson and Peterson 2002). Common diet items include birds and small mammals (Dewey and Perepelyuk 2000). Wildlife surveys will be completed to determine if Cooper's hawk is active within the project area, if active nests are found they will be flagged with a generous buffer. All construction activities will occur outside of normal nesting time for the species. No impacts are expected due to project activities.

Sharp-shinned hawk *Accipiter striatus*

The sharp-shinned hawk is the smallest hawk in North America. Adults range from 9.4 – 13.4 in (24 – 34 cm) in length and average ~0.3 lb (~150 g) in weight. Individuals are blue-gray in color with a dark head and white underside with brown bars (Camfield 2004). The sharp-shinned hawk is primarily found throughout forested regions of North America, but can also be found in suburban and agricultural areas (Snyder and Snyder 1991; Bildstein and Meyer 2000). Breeding corresponds to maximum prey availability and usually occurs from March through June. Nests are built below the forest canopy in trees and re-used in multiple years. The species is territorial and actively defends nest sites during the breeding season (Camfield 2004). Home range size varies and is typically 222 – 692 ac (0.9 – 2.8 km^2) (Bildstein and Meyer 2000). Common diet items include small birds, small mammals, and large insects (Bildstein and Meyer 2000; Camfield 2004). Wildlife surveys will document activity of sharp-shinned hawks in the project area. Nests will be flagged and buffered, if detected and active. Construction activity will occur outside of breeding time. No impacts are expected due to project activities.

Prairie Falcon (nesting) *Falco mexicanus*

The prairie falcon is a large, light brown falcon with distinctive facial features that include black malar streaks, a dark ear patch, and a white patch between the ear patch and eyes. Prairie falcons can be distinguished from similar species by a dark, triangular patch on the underside of their wings. Adults range from 14.6 – 18.5 in (37 – 47 cm) in length and average ~1.5 lb (~700 g) in weight (Goulet and Fraser 2007). In Canada, the prairie falcon is found throughout the desert and prairie regions of the central and western provinces. In the U.S., the prairie falcon is found throughout the Central Plains to the Desert Southwest (Terres 1980; Steenhof 1998). The species prefers open grasslands during spring and autumn migrations, but is commonly found in desert and open grasslands during winter (Goulet and Fraser 2007). Prairie falcons breed in open areas

with cliffs and bluffs for nesting. Nest sites are typically scraped on a ledge and shared with other species, such as common ravens, golden eagles, and red-tailed hawks. Breeding peaks from April through May. Home range sizes vary by region and are increased during breeding (Steenhof 1998). Common diet items include ground squirrels, other birds, and reptiles (Teres 1980; Steenhof 1998). Wildlife surveys will document activity of nesting prairie falcons in the project area, and if active nests are detected they will be flagged and buffered. Construction activity will occur outside of breeding time. No impacts are expected due to project activities

Swainson's Hawk *Buteo swainsoni*

The Swainson's hawk is a medium-sized hawk that breeds in California and may migrate to Mexico and South America in the winter. The hawks often nest peripherally to riparian systems of the valley as well as utilizing lone trees or groves of trees in agricultural fields; valley oak, Fremont cottonwood, black walnut and large willow are the most commonly used nest trees in the Central Valley. The hawks require large open grasslands with suitable nest trees and abundant prey. Migrating individuals move south through the southern and central interior of California in September and October, and north March through May. Breeding occurs late March to late August. Nesting occurs primarily in the southern Sacramento Valley and northern San Joaquin Valley regions (Stillwater Sciences 2005). Swainson's hawk has been documented in the area of the project. To meet CDFG's recommendations for mitigation and protection of Swainson's hawks, surveys will be conducted by a qualified biologist for a ½ mile radius around all project activities according to the *Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley* (Swainson's Hawk Techical Advisory Committee 2000). Site surveys will identify suitable foraging, roosting, and nesting habitat and species presence. If nesting Swainson's hawk is confirmed, a minimum 0.25 mi (0.40 km) buffer will be established around the nest and CDFG will be contacted to discuss implementation changes and/or additional avoidance measures. Swainson's hawks are unlikely to be impacted by the construction and operation of the proposed project because of the timing of the project and implementation of mitigation measures (see Mitigation Measure 8). In addition, this project will ultimately provide a benefit for Swainson's hawks by improving foraging habitat along the Merced River and by providing additional trees that will eventually reach a size appropriate for use as nest trees. Although Swainson's hawks will nest in trees located in upland areas, their strong association with riparian forests suggests that protection and restoration of these habitats may provide nesting habitat superior to other sources of trees such as those on roadsides or along field margins. Additionally, other bird species that occupy the mature tree and gallery forest component of riparian systems will also benefit from conservation or restoration of the river landscape (Woodbridge 1998).

Yellow-breasted Chat (nesting) *Icteria virens*

The yellow-breasted chat *Icteria virens* are very large, aberrant warblers with distinctive plumage. They have olive green to grayish upperparts with lemon-yellow chin, throat, and breast; the large bill has a strongly curved culmen. The face of this species is grayish with black lores, white supercilium, and white eye-crescent on lower eye-lid (Eckerle and Thompson 2001). They are an uncommon summer resident and migrant in coastal California and in foothills of the Sierra Nevada. The yellow-breasted chat migrates through areas near the project site on the Merced River during the summer months (McCaskie et al. 1979). No impacts to the yellow-breasted chat are expected since project activities will occur after their summer migration.

Tri-color Blackbird *Agelaius tricolor*

The Tri-colored blackbird ranges from Northern California in the U.S. (with occasional strays into Oregon) to upper Baja California in Mexico. This species forms the largest colonies of

North American landbirds, as it is highly social and gregarious. Nesting colonies may consist of tens of thousands of individuals. This social nature makes the bird vulnerable to impacts from urban and agricultural land uses. Native grasslands once used for nesting and feeding have been lost to urban and agricultural development. Birds adapting to nesting in agricultural fields have been disturbed by harvesting during the breeding season. No impacts to this species will occur since no records of this species occur in the CNDDB for the Merced River corridor, and typical nesting habitat is not present in the project footprint.

Other Special Status Bird Species

Other Special Status bird species that have potential to occur in the vicinity of the proposed project include: Double-breasted cormorant *Phalacrocorax auritus*; Great blue heron *Ardea herodias*; Great egret *Casmerodius albus*; Western burrowing owl *Speotyto cunicularia hypugea*; Bell's sage sparrow *Amphispiza belli belli*; and California yellow warbler (nesting) *Dendroica petechia brewsteri* (Stillwater Sciences 2002, 2005). Few of these species have been documented in the MRR, but they will not be affected by the construction and operation of the proposed project because of the timing of the project (see Mitigation Measure 8).

Special Status Mammal Species

Western Red Bat *Lasiurus blossevillii*

The red bat has an upper body that is brick red to rusty red washed with white; males are usually more brightly colored than females. Red bats are locally common in some areas of California, occurring from Shasta County to the Mexican border, west of the Sierra Nevada/Cascades Crest, and deserts. Roosting habitat includes forests and woodlands between sea level and mixed coniferous forest. Preferred roost sites are in edge habitat adjacent to streams, fields, or urban areas. Roost sites are usually solitary, and can be between 2 ft and 40 ft (0.6 m and 12.2 m) from the ground. The red bat has been noted in the project quadrant within the CNDDB database. Cottonwood riparian habitat associated with the Merced River provides significant roosting and foraging habitat for reproductive female red bats during the summer. These species will not be impacted by the construction and operation of the proposed project because of the minimization of impacts to riparian habitat (see Mitigation Measure 1). Since the project will result in an increase in riparian habitat, the project will result in long-term benefits to this species.

Pallid Bat *Antrozous pallidus*

The pallid bat is a large, light colored bat with large prominent ears. Pallid bats are common in desert and grassland habitats throughout the southwestern U.S., especially in areas near water (Hermanson and O'Shea, 1983). Pallid bats roost in small colonies in rock crevices and man-made structures, and rarely in caves. Diurnal roosts may be shared with other bat species such as the Brazilian free-tailed bat and Yuma myotis (Hermanson and O'Shea 1983). Pallid bats forage between 0.5 and 2.5 km from the day roost. Although locally common, populations are very sensitive to disturbance of roosting sites. Pallid bats have been noted in the project quadrant within the CNDDB database. Neighboring bridges may serve as a summer maternity roost for this species, and the adjacent riparian corridor served as summer foraging habitat. These species will not be impacted by the construction and operation of the proposed project because of the minimization of impacts to riparian habitat (see Mitigation Measure 8, 9). Since the project will result in an increase in riparian habitat, the project will result in long-term benefits to this species.

American Badger *Taxidea taxus*

The American badger is a large, gray to reddish colored member of the weasel family (Mustelidae). American badgers are short and stout with a flattened body that is built for digging.

Adults range from 20.5 – 34.4 in (52.0 – 87.5 cm) in length and may weigh up to 26.5 lb (12 kg) (Shefferly 1999). The American badger is common in the Great Plains region of North America, but can be found throughout central and western Canada, the western U.S., and northern Mexico. The eastern limit of the species' range is Ontario, Canada (Kurta 1995; Long 1999). American badgers prefer dry, open grasslands, but can be found in mountain and desert regions (Long 1999). Badgers are primarily active at night when they dig burrows in search of rodent prey (Shefferly 1999). Dens are up to 9.8 ft (3 m) below the surface and may contain up to 32.8 ft (10 m) of tunnels (Kurta 1995; Long 1999). Home ranges are typically small (males = 593 ac [2.4 km^2] and females = 395 ac [1.6 km^2]; Shefferly 1999), but are expanded during mating season in late summer through early autumn (Long 1999). Pre-construction surveys will be conducted by qualified wildlife biologists to determine the use of the project site by American badgers; surveys will focus on identification of potential badger dens within the construction footprint and a minimum 250 ft (76.2 m) buffer around the construction footprint. If badger dens are located within the construction or buffer area, prior to initiation of construction CDFG will be consulted for further instructions on methods to avoid direct impacts to this species (Mitigation Measure 10).

San Joaquin Kit Fox *Vulpes macrotis mutica*

Comparable in size to a small dog or large cat, the San Joaquin kit fox is the largest of the eight subspecies of kit fox. San Joaquin kit fox are basically nocturnal, but they occasionally come out during the day, and the pups may be seen playing near the den. A mated kit fox pair may use up to 39 dens in a single year, although a fox usually spends its primarily solitary life within a 1 – 2 square mile area. They either dig these dens themselves or enlarge squirrel or badger dens. Natal dens, generally the largest and most complex type of den, may be constructed over a period of several years (Morrell 1972). Kit fox are also known to use manmade structures, such as small-diameter culverts. The San Joaquin kit fox historically inhabited the semi-arid regions of California's Central Valley and adjacent foothills. Much of this range has been reduced as a result of agricultural and urban development and they are now primarily found in the grasslands and scrub habitats of the southern San Joaquin Valley. They are also found in and adjacent to agricultural and urban areas (Spiegel et al. 1996). In 1965, the California Fish and Game Commission classified the San Joaquin kit fox as a protected furbearer, and in 1971 the State classified it as "rare" (now Threatened) under the 1970 California Endangered Species Act. The U.S. Secretary of the Interior listed the subspecies as Endangered under the Endangered Species Protection Act of 1973, as amended. In the north, the habitat is so fragmented by urbanization and agriculture that this portion of the population is very close to extinction. Kit fox throughout their range are also subject to disease, predation, roadkill, off-road vehicles, shooting, trapping, and rodenticide mortality. Potential habitat for the San Joaquin kit fox is present on both sides of the river in large expanses of intact grassland habitat and in dry farmed areas. Preliminary walking surveys of this potential habitat yielded no potential dens or sign indicative of this species, and the construction footprint is not typical kit fox habitat nor does it have the friable soils needed for denning. Pre-construction surveys will be conducted by qualified wildlife biologists, which will determine the use of the project site by San Joaquin kit fox; surveys will focus on identification of potential, atypical, active, and natal (USFWS 1999) kit fox dens within the construction footprint and a minimum 500 ft (152.4 m) buffer around the construction footprint. If potential kit fox dens are located within the construction or buffer area, a minimum of five consecutive nights of camera/scent stations and track stations will be placed by the den entrances in order to determine if the den is in use by kit fox (Mitigation Measure 10). If active or natal dens are confirmed, CDFG and USFWS will be consulted for further instructions on methods to avoid direct impacts to this species as well as the need for incidental take permits.

4.4.3.2 Criteria for Determining Significance

Impacts to wildlife resources would be considered significant if they resulted in any one of the following:

- direct mortality of federally or state listed wildlife species;
- temporary impacts to habitat of federal or state listed wildlife species resulted in increased mortality or lowered reproductive success; and/or,
- permanent loss of designated critical habitat for federal or state listed wildlife species.

4.4.3.3 Environmental Consequences

4.4.4.3.1 No Action Alternative

Under a No-Action Alternative, no impacts to wildlife resources would occur.

4.4.4.3.2 Proposed Project

Temporary impacts to wildlife species may occur as a result of the proposed project due to temporary loss of riparian habitat and daytime disturbances due to construction activities. Impacts to blue elderberry shrubs, which provides critical habitat for valley elderberry longhorn beetle will be reduced to less than significant by implementing avoidance and protective measures outlined in this document and according to the July 1999 USFWS conservation guidelines. Impacts to other sensitive wildlife species will be reduced to less than significant by conducting pre-construction surveys. If sensitive species are observed, agency recommended avoidance and conservation measures will be implemented. Moreover, all gravel extraction areas and temporary access routes will avoid any disturbance of trees or dense vegetation.

4.4.4 Fish

4.4.4.1 Affected Environment

Fish habitat in the Merced River below the Crocker-Huffman Dam has been impacted by many factors, most prominently by extensive mining activities. The MRR is located within the DTR of the Merced River. The landscape of the DTR is characterized by tailing piles. The changes to the landscape severely reduce the availability of spawning and rearing habitat for salmonids. Also, deep mining pits provide habitat for Sacramento pikeminnow *Ptychocheilus grandis*, largemouth bass *Micropterus salmoides*, and striped bass, species that prey on juvenile salmonids. Spawning and rearing habitat in the lower Merced River are further degraded by highly regulated flows and the diking of floodplains for agriculture. The reservoirs have greatly reduced the amplitude and frequency of flood flows and together with the dikes, very little of the historical floodplains exist, and those that do are infrequently inundated at times most beneficial to salmonids. Without inundation, the floodplains cannot provide terrestrial food for juvenile salmon or organic matter that helps produce more food within the river. Moreover, the lack of peak flood flows allows encroachment of riparian vegetation which along with the dikes tend to confine flood flows to the river channel. This in turn accelerates the rate that gravel is scoured from spawning and rearing habitat. With high rates of scour, spawning and rearing habitat tends to erode away and the river tends to widen because the upstream reservoirs block gravel recruitment from the upper watershed (Kondolf et al. 2001).

Water diversions for urban and agricultural use in all three San Joaquin River tributaries reduce flows and potentially result in unsuitably high water temperatures. Species of fish that have been observed in the vicinity of the project area include fall-run Chinook salmon, steelhead, rainbow trout, striped bass, largemouth bass, smallmouth bass *M. dolomieu*, Sacramento pikeminnow, Carp *Cyprinus carpio*, goldfish *Carassius auratus*, hitch *Lavinia exilicauda*, Sacramento blackfish *Orthodon microlepidotus*, tule perch *Hysterocarpus traski*, black bullhead *Ameiurus melas*, among others.

4.4.4.1.1 Special Status Fish Species

Special-status fish species are defined as taxa that are: (1) designated as threatened or endangered by the state or federal governments; (2) proposed or petitioned for federal threatened or endangered status; (3) state or federal candidate species; or (4) identified by the CDFG as Species of Special Concern.

Of the special-status species identified by the USFWS or from the California Natural Diversity Data Base, only fall-run Chinook salmon, steelhead, river lamprey, and hardhead occur in the project area. It is highly unlikely that green sturgeon, longfin smelt *Spirinchus thaleichthys*, or delta smelt *Hypomesus transpacificus* occur in the project vicinity as their habitat is typically found well downstream of the project area.

Delta Smelt *Hypomesus transpacificus*

Delta smelt are small, slender bodied smelts that are 2 – 2.8 in (5 – 7 cm) long as adults. They have a steely blue sheen on the sides and seem almost translucent. Delta smelt live together in schools and feed on zooplankton. They are endemic to the greater Sacramento-San Joaquin Delta system. They are a pelagic fish that prefer delta habitat in the mixing zone. Delta smelt are not known to occur in the lower Merced River.

Chinook Salmon *Oncorhynchus tshawytscha*

The Merced River is currently the southernmost extent for populations of Chinook salmon and Central Valley steelhead/rainbow trout, which are considered species of concern under the federal Endangered Species Act (ESA). There are four races of Chinook salmon: fall-, late-fall, winter-, and spring-run. Life history difference among species is mostly the timing of return to freshwater for spawning (Moyle 2002). Historically, both spring- and fall-run Chinook salmon were known to exist in the Merced River, up to elevations of ~2,000 ft (610 m) near El Portal (Yoshiyama et al. 2000). By 1925, Crocker-Huffman, Merced Falls, and Exchequer dams had eliminated access to the upper Merced River (Stillwater Sciences 2005). Since 1971, CDFG has operated the Merced River Hatchery located at the base of Crocker-Huffman Dam with a maximum annual production of 960,000 fish (Stillwater Sciences 2005). The average take is 1.1 million eggs annually (T. Heyne, pers. comm.). Approximately 40% of smolts produced at the hatchery are released in the Merced River; the rest are used as study releases in the Tuolumne, Stanislaus, and San Joaquin rivers (Stillwater Sciences 2005). Chinook salmon life history and populations in the Merced River are not well documented, but studies in recent years by CDFG, MID and AFRP have provided additional information. Fall-run Chinook salmon escapement estimates were extremely low for all San Joaquin River tributaries, including the Merced River in 2007 and 2008, increasing the importance of understanding current population dynamics, targeting restoration efforts to improve conditions, and monitoring the effectiveness of all efforts (Montgomery et al. 2007, 2008).

The majority of spawning in the Merced River takes place from Crocker-Huffman Dam (RM 52) to just below Snelling, California. The Final Restoration Plan for the Anadromous Fish Restoration Program (USFWS 2001) calls for a fall-run Chinook salmon production target of 18,000 fish for the Merced River. Escapement and returns of adults to the Merced River have been extremely poor in the last several years (Montgomery et al. 2007, 2008; CDFG, unpublished data). Redd surveys conducted in 1997 and 1998 found over half of the redds in the Merced River occur in the DTR. The annual fall-run Chinook salmon migration in the Merced River begins in early September, peaks in November, and tapers off in December and early January. Spawning generally occurs shortly after migration, primarily from late October through January. Embryos incubate and alevin hatch in redd gravels between October and April, depending on time of spawning and water temperature. Fry begin to emerge from the gravel starting in January and continuing until April. Most juvenile Chinook salmon in the Merced River have left the spawning areas by June of their first year. From June to September, no Chinook salmon are known to be in the Merced River. Chinook salmon spawn in moderately-sized cobble in riffles and pool tailouts (Stillwater Sciences 2005). Spawning distribution and incubation success are important factors controlled by substrate size and intergravel flow (Harrison 1923; Hobbs 1937; McNeil 1964; Cooper 1965; Platts 1979; Merz et al. 2004). Female Chinook salmon will excavate a redd that is typically 111 – 189 ft^2 (10.3 – 17.6 m^2) in size (Healey 1991). The female defends the redd until death, and fertilized eggs will incubate for about 13 weeks, depending on water temperature (Bjornn and Reiser 1991). Larvae hatch with yolk sacs and remain in substrate until the sac is absorbed, about 2 – 3 weeks. Emerging fry disperse downstream or to lateral margins of river. Large numbers of fry have been captured at the mouth of the river in wet years (Stillwater Sciences 2005). Subyearling smolts typically out-migrate from April to May, but may be as late as June. All construction activities will take place during the late summer when few salmonids are known to use the MRR. We do not expect impacts to Chinook salmon as a result of this project; moreover, we expect project actions will improve conditions for rearing and spawning salmonids.

Central Valley Steelhead *O. mykiss*

Steelhead have the greatest diversity of life history patterns of any Pacific salmonid species, including varying, degrees of anadromy, differences in reproductive biology, and plasticity of life history between generations. Only winter-run steelhead currently occur in Central Valley streams (McEwan and Jackson 1996). They prefer cold water between 55°F – 70°F (13°C – 21°C) that is saturated with dissolved oxygen. In the Merced River, the two forms of steelhead exist: the form that remains in the river its entire life, and the anadromous form that migrates to the ocean and returns to the river to spawn, multiple times. The relationship between resident and anadromous forms is not well understood, but some evidence suggests the two forms interbreed and produce juveniles of the alternate form (Shapovalov and Taft 1954; Burgner et al. 1992; Hallock 1989). No genetic differentiation has been found between forms, supporting this hypothesis (Busby et al. 1993; Nielsen 1994).

Central Valley steelhead are listed as threatened by federal ESA. The Merced River is included in the designated critical habitat (NMFS 2000). Critical habitat is defined by ESA as specific areas within a geographic region where the habitat values are essential for conserving the species. This designation includes river and adjacent riparian areas (NMFS 2000), and restoring spawning and rearing areas may be important for conservation (Stillwater Sciences 2005). Little is known about steelhead in the Merced River. In the Sacramento River, adult winter steelhead migrate upstream during most years from July to March (Bailey 1954; Hallock et al. 1961). Spawning occurs from January to March. Central Valley steelhead typically return from the ocean at ages two or three, weighing 2 – 12 lbs (0.9 – 5.4 kg) (Reynolds et al. 1993). There have been no

juvenile trout or migrating steelhead caught in the downstream rotary screw trap in 2007 and 2008 (Montgomery et al. 2007, 2008). Limited reports exist of steelhead from other sources including CDFG and NRS. Anadromous steelhead will not be impacted by project activities. Project activities will occur before the spawning period. Resident rainbow trout are known to be present in the river year-round. No impacts are expected due to project activities, and improvement in habitat is expected following construction.

Kern brook Lamprey *Lampetra hubbsi*

The Kern brook lamprey is found in the lower reaches of the Merced, Kaweah, Kings and San Joaquin river systems (Stillwater Sciences 2005). Silty backwaters in large rivers are the preferred habitat. The larval stage lamprey (ammocetes) are usually found in shallow pools along the edge of runs, using substrates such as sand, gravel and rubble (Moyle et al. 1995). The Kern brook lamprey is impacted by the fragmentation and reduction of habitats from channelization (Moyle et al. 1995). No impacts are expected due to project activities, and improvement in overall habitat condition for native fish is expected following construction.

Hardhead *Mylopharodon conocephalus*

The hardhead is a special status freshwater fish native to California and limited to the Sacramento-San Joaquin and Russian river systems (Moyle 2002). Juvenile hardhead inhabit may be found at various temperature gradients, in shallow regions and deeper lake habitats. Spawning occurs in May and June in the sand, gravel and rocky areas of pools and side pools. Juveniles feed on plankton, insects, and small snails (Reeves 1964). Moyle and Nichols (1973) reported that the overall population of hardhead has been declining rapidly. No impacts are expected due to project activities, and improvement in overall habitat condition for native fish is expected following construction.

Sacramento Splittail *Pogonichthys macrolepidotus*

The Sacramento splittail is endemic to the Central Valley and the Delta. The historic range included much of the San Joaquin River valley. They spawn from March through April in the upper reaches of large streams. The adults congregate for 2 – 3 months before spawning in areas of inundated floodplain vegetation. After spawning they move downstream to the Delta and remain there until the fall rains have begun. Dam, water diversions, and agriculture have reduced this species range by 35 – 60% (Stillwater Sciences 2005). Non-native invasive species may also have had an impact on this species. No impacts are expected due to project activities, and improvement in overall habitat condition for native fish is expected following construction.

4.4.4.2 Criteria for Determining Significance

Impacts to fishery resources would be considered significant if they resulted in any one of the following:

- direct mortality of federally or state listed fish species;
- temporary impacts to habitat of federal or state listed species resulted in increased mortality or lowered reproductive success; and/or,
- permanent loss of designated critical habitat for federal or state listed species.

4.4.4.3 Environmental Consequences

4.4.3.3.1 No Action Alternative

Under a No-Action Alternative, the past excavation of gravel beds in the project area would continue to result in: (1) increased mortality of salmonid eggs and alevins due to redd superimposition in overcrowded spawning habitat; (2) increased juvenile mortality due to reduced food availability and reduced refuge from predators; and, (3) continued lack of gravel recruitment due to the impoundment created by dams upstream of the project area.

4.4.3.3.2 Proposed Project

The proposed project will improve spawning habitat for Chinook salmon and steelhead by placing gravel in the river mainstem and reconnecting the floodplain to the river. This project will temporarily increase sediment loads into the river, potentially reducing dissolved oxygen; however all work will occur during periods of low salmonid use. This proposed project aims to improve habitat for spawning and rearing steelhead. Although there may be temporary impacts resulting from increased sediment mobilization, the long-term goals of the project will significantly improve habitat for steelhead.

4.5 Recreation and Public Safety

4.5.1 Affected Environment

There is a fishing access site, Cuneo fishing access, adjacent to the MRR. This recreation site includes a trail for fishing access to the river and public facilities.

4.5.2 Environmental Consequences

4.5.2.1 No Action Alternative

The recreational opportunities and public safety concerns would not be affected under the No-Action alternative.

4.5.2.2 Proposed Project

The project has a minor positive impact on recreation by providing a restored river landscape at the Cuneo fishing access area; however, no recreation facilities will be constructed as part of this project. Activity at the Cuneo access may increase as interested parties are able to witness restoration actions in progress. Interpretive signage will be added to provide detailed information and project progress information to the public.

4.6 Socioeconomic Conditions and Land Use

4.6.1 Affected Environment

The land adjacent to the project area is rural, and is used for agriculture, aquaculture, or aggregate mining. There is a public access site on the north side of the river: the Cuneo fishing access. Restored areas will be accessible to the public following project completion from this access site.

4.5.2 Environmental Consequences

4.5.2.1 No Action Alternative

Socioeconomic and land use conditions and issues would not be affected under the No-Action alternative.

4.5.2.2 Proposed Project

The proposed project will operate construction equipment (e.g., rubber-tired front-end loaders, end-dump haulers, etc.) in the project area. These operations will temporarily increase ambient noise levels in the vicinity of the sites. Gravel processing will occur onsite to reduce transport activities. Construction equipment will be properly equipped and maintained to reduce noise levels. The types of construction equipment used for this project will typically generate noise levels 80 – 90 decibels above the reference noise at a distance of 50 ft (15.2 m). The project will not expose people to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies because the project is a significant distance from populated areas. All changes in noise levels will occur for a limited duration, in a mostly rural and relatively unpopulated area. However, the impact is still considered significant because there will be increases in noise levels at the project site, and there is limited housing and recreational use within 1 mi (1.6 km) of the project area. The impact will be mitigated to a less than significant level with implementation of the mitigation measures outlined below. The project has the potential to increase vibration and noise levels in the immediate project area, but will not expose people to excessive vibration or noise levels. Any changes in vibration and noise will occur for a limited duration in a rural, relatively unpopulated area, and will occur within established standards for noise. Any potential impacts will be mitigated by the measures outlined below. The project will not support a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project, because construction activities associated with the project will only occur during a limited period of time. Any increases above the ambient noise level will be mitigated by the measures outlined below.

Mitigation Measure 12. To mitigate noise related impacts, the project will require all contractors to comply with the following conditions:

- restrict construction activities to time periods when there is the least potential for disturbance;
- install and maintain sound-reducing equipment and muffled exhaust on all construction equipment; and,
- optimize the location of processing equipment to be the least disturbance in terms of noise for the local residents.

4.7 Cultural Resources

4.7.1 Affected Environment

As part of the preparation for this project, a cultural resource study was conducted in 2006 (URS 2006b). Impacts to cultural resources are considered if the resource is “significant” or “important” or “unique archaeological resource” under the provisions of CEQA Sections 15064.5 and 15126.4. There were no previously recorded cultural resources identified within the project area of potential effect (APE), and thus impacts are not anticipated. Additionally, compliance

with Section 106 of the National Historic Preservation Act (NHPA) is necessary. Even with these measures undertaken, it is possible that during construction activities unknown cultural resources could be unearthed.

4.7.2 Criteria for Determining Significance

Cultural resource importance and significance is determined by listing in the National Register of Historic Places. The significance criteria for listing are defined in 36 CFR 60.4 as follows:

- places that are associated with events that have made a significant contribution to the broad patterns of our history;
- places associated with the lives of persons significant in our past;
- places that embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction; or,
- places that have yielded, or may be likely to yield, information important in prehistory or history.

4.7.3 Environmental Consequences

4.7.3.1 No Action Alternative

The No-action alternative will not have an effect upon cultural resources.

4.7.3.2 Proposed Project

This potentially significant impact could be mitigated to a less significant impact by implementation of the following:

Mitigation Measure 13. If any objects of cultural significance are unearthed during the construction process, work will be halted until a qualified archeologist can assess the significance of the new find. If human remains are unearthed during the construction process, the project team will comply with the California Health and Safety Code Section 7050.5, which states that no further disturbance shall occur until the County Coroner has investigated the situation following the Public Resource Code Section 5097.98.

5.0 CUMULATIVE IMPACTS

The MRR restoration project will implement appropriate mitigation measures to reduce the impacts to the surrounding environment to less than significant levels. There will be temporary and minor adverse effects that will occur at the construction and processing sites; however, the overall improvement to the environment will outweigh these effects. This project will not contribute to the accumulation of impacts in the watershed. However, cumulative actions to improve stream habitats in the watershed are expected to provide long-term benefits to associated vegetation, wildlife, and fish. Because vegetation communities and wildlife habitats within the Merced River watershed have been substantially modified to suit human land uses and will likely continue to be modified as human populations increase, cumulative benefits from proposed actions over time may be partially offset with new adverse impacts in the watershed.

Other related activities aimed at salmonid production, enhancement, restoration, and mitigation are being planned and implemented for the Merced River system and Central Valley under directives of the CVPIA, CALFED, and AFRP. These activities include screening water diversions, water acquisition, improving fish passage, riparian habitat restoration, and other enhancement actions. The magnitude of cumulative effects under all current and proposed salmonid habitat improvement actions is undetermined at this time.

5.1 Related Activities

5.1.1 Restoration Activities in the Merced River

The MRR restoration project is one of several projects in the Merced River aimed at restoring ecosystem processes within the watershed. These projects will enhance spawning and rearing areas within the Merced River and eventually contribute to the increase in population abundance for imperiled salmonids.

5.1.2 The Ecosystem Restoration/CALFED Bay-Delta Program Plan

The related CALFED program was formed to develop a long-term comprehensive plan that will restore the ecological health and improve water management for beneficial uses of the San Francisco Bay/Sacramento-San Joaquin Delta system. The program has the potential to provide an additional funding source for actions designed to contribute to the overall health of the Merced River ecosystem, including anadromous fish habitat.

5.1.3 Fish Screening Program

The ongoing CVPIA fish screening program is targeted at anadromous fish entrainment reductions through screening unscreened diversions and upgrading inadequate fish screens throughout the State. This activity is designed to reduce anadromous fish losses at water diversion sites. Reducing entrainment losses has the potential to increase populations by reducing juvenile fish mortality. Unscreened or improperly screened diversions can result in the loss or entrainment of juvenile salmonids.

5.1.4 Tracy Fish Facility Direct Loss Agreement

The CDFG and the USBR entered into an agreement in late 1986 to offset direct losses of striped bass, Chinook salmon and steelhead caused by the diversion of water by the Tracy Pumping Plant owned and operated by the USBR. Direct losses were defined as losses of fish which occur from the time fish are drawn into Clifton Court Forebay until the surviving fish are returned to the Delta (CDFG 1993). The agreement provides funding for mitigation measures that are proposed to offset these losses and increase the relative abundance of those species.

6.0 CONSULTATION AND COORDINATION

The USFWS is the lead federal agency under NEPA, the CDFG is the lead state agency under CEQA, and CFS is responsible for the development of the proposal, design, permitting, and implementation of the proposed project with the guidance of CDFG and USFWS. The CFS team prepared the EA/IS on behalf of the two lead agencies, which assessed the impacts of the MRR Restoration Project as required by CEQA and NEPA. The CFS project team includes engineers with PWA, a botanist, and statistics expert. This environmental document was reviewed by the lead agencies prior to public release, by other appropriate regulatory agencies, and will be available for public review and comment.

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8.0 ENVIRONMENTAL CHECKLIST FOR CEQA

This section discusses potential environmental impacts associated with approval, construction, operation, and maintenance of the proposed project. The following guidance, adapted from Appendix G of the State CEQA Guidelines (California Code of Regulations, Title 14, Division 6, Chapter 3, Sections 15000 – 15387; 27 July 2007) was followed. A brief explanation is required for all answers except "No Impact" answers that are adequately supported by the information sources a lead agency cites. A "No Impact" answer is adequately supported if the referenced information sources show that the impact simply does not apply to projects like the one involved (e.g., the project falls outside a fault rupture zone). All answers must take account of the whole action involved, including off-site as well as on-site, cumulative as well as project-level, indirect as well as direct, and construction as well as operational impacts. "Potentially Significant Impact" is appropriate if there is substantial evidence that an effect may be significant. If there are one or more "Potentially Significant Impact" entries when the determination is made, an EIR is required. "Negative Declaration: Potentially Significant Unless Mitigation Incorporated" applies where the incorporation of mitigation measures has reduced an effect from "Potentially Significant Impact" to a "Less Significant Impact." Earlier analyses may be used where, pursuant to the tiering, program EIR, or other CEQA process, an effect has been adequately analyzed in an earlier EIR. Lead agencies are encouraged to incorporate into the checklist references to information sources for potential impacts (e.g., general plans, zoning ordinances). The analysis of each issue should identify: (1) the significance criteria or threshold used to evaluate each question; and (2) the mitigation measure identified, if any, to reduce the impact to less than significance.

I. Land Use and Planning

Would the project:

	Potentially Significant Impact	Potentially Significant Unless Mitigated	Less Than Significant Impact	No Impact
a) Physically divide an established community?	0	0	0	X
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	0	0	0	X
c) Conflict with any applicable habitat conservation plan or natural communities' conservation plan?	0	0	0	X

Discussion

The project does not physically divide an established community. The project does not conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or

zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect. The proposed project would not have an adverse impact on land use and planning.

II. Agricultural and Forest Resources Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigated	Less Than Significant Impact	No Impact
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance, as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	0	0	0	X
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	0	0	0	X
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?	0	0	0	X
d) Result in the loss of forest land or conversion of forest land to non-forest use?	0	0	0	X
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use?	0	0	0	X

Discussion

The project does not involve land conversion, and does not conflict with existing zoning for agriculture use or a Williamson Act contract; therefore, no impacts to agriculture will occur. This project does not occur on forest land and will have no impact on any timber resources.

III. Population and Housing

Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigated	Less Than Significant Impact	No Impact
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	0	0	0	X
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	0	0	0	X
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	0	0	0	X

Discussion

The project would not create housing or attract a new development; therefore the project does not have a direct or indirect affect on substantial population growth. Implementation of this project in the Merced River does not displace housing or residents, or cause the construction of replacement housing in another location.

IV. Geology and Soils

	Potentially Significant Impact	Potentially Significant Unless Mitigated	Less Than Significant Impact	No Impact
Would the project expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death by:				
a) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault?	0	0	0	X
i) Strong seismic ground shaking?	0	0	0	X
ii) Seismic-related ground failure, including liquefaction?	0	0	0	X
iii) Inundation by seiche, tsunami, or mudflow?	0	0	0	X
iv) Landslides?	0	0	0	X
v) Flooding, including flooding as a result of the failure of a levee or dam?	0	0	0	X
vi) Wildland fires, including where wildlands are adjacent to urbanized areas and where residences are intermixed with wildlands?	0	0	0	X
b) Would the project result in substantial soil erosion or the loss of topsoil?	0	0	X	0
c) Would the project result in the loss of a unique geologic feature?	0	0	X	0
d) Is the project located on strata or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	0	0	0	X
e) Is the project located on expansive soil creating substantial risks to life or property?	0	0	0	X
f) Where sewers are not available for the disposal of wastewater, is the soil capable of supporting the use of septic tanks or alternative waste water disposal systems?	0	0	0	X

Discussion

Merced County is in an area of California that is known to be seismically active. Ground shaking in the area is primarily related to the San Andreas fault system. The project site is likely to experience seismic activity, but because there are no permanent structures or buildings created as part of the project; there is no increase in risk. The project would not pose any additional risk to people or structures due to a rupture of a known earthquake fault, this includes any potential risks from strong seismic ground shaking, seismic-related ground failure, including liquefaction; inundation by seiche, tsunami, or mudflow; landslides; and, flooding, including flooding as a result of the failure of a levee or dam. The project is no more susceptible to wildland fires due to project activities, and wildland fires would be expected to cause minimal damage in the area, as it is a natural landscape of which fire is an integrated component. There are no urbanized areas nearby. Construction activities associated with the project could result in temporary increases in erosion of soils and changes in topography. The project would not result in substantial soil erosion or the loss of topsoil, in fact project activities would contribute to the retention of soil across the recovered floodplain. Mitigation measures to protect water quality for these temporary effects will be in place, so no significant impact is anticipated from project activities. The project would not result in the loss of a unique geologic feature. The project is not located on strata or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse. In fact, the project is meant to ameliorate extensive damage caused to the natural landscape and return it to a more natural form. The project is not located on expansive soil creating substantial risks to life or property. The project does not require sewers, septic tanks, or alternative wastewater disposal systems. The project will remove and process mining tailings along the Merced River, and restore floodplain and channel conditions to benefit juvenile and adult Chinook salmon and steelhead. These activities will not cause adverse effects in the geology or soils, or pose any additional risk from seismic activity. The project area is within a rural landscape, and within the MRR structures and activities are limited to those supporting the Merced River Fish Hatchery.

V. Greenhouse Gas Emissions

Would the project:

	Potentially Significant Impact	Potentially Significant Unless Mitigated	Less Than Significant Impact	No Impact
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	0	0	X	0
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	0	0	0	X

Discussion

The project does involve the use of heavy machinery, but the project duration is short (2 weeks) and the emission of greenhouse gases limited. The impact to the environment is less than significant, and offset by the improvement in habitat conditions and function following project completion.

VI. Hydrology and Water Quality

Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigated	Less Than Significant Impact	No Impact
a) Violate Regional Water Quality Control Board water quality standards or waste discharge requirements?	0	X	0	0
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (i.e., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	0	0	0	X
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?	0	0	0	X
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	0	0	0	X
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems to control?	0	0	0	X
f) Place housing within a 100-year floodplain, as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	0	0	0	X
g) Place within a 100-year floodplain structures which would impede or redirect flood flows?	0	0	0	X

Discussion

The project does not violate regional water quality objectives for inland surface waters. The project will have little effect on bacteria levels, and no biostimulatory substances will be used. The project does not substantially deplete groundwater supplies or interfere substantially with groundwater recharge. No net deficit in aquifer volume or a lowering of the local groundwater table level (i.e., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted) would occur because of the project. Project activities likely will improve groundwater recharge as floodplain function is restored. The project could cause minor changes in existing river currents and direction around the gravel placement areas. Such changes are intentional to enhance

spawning and rearing habitat for salmonids. The changes are highly localized and beneficial to aquatic organisms, so the impacts are considered less than significant. The project does alter a river in a way that affects instream erosion and siltation, but not in a way that causes substantial risks. The project activities will restore the floodplain's capability to function as rearing habitat for juvenile salmonids, and the channels ability to support spawning adult salmon and steelhead. Development of the project will increase the absorption rates for floodwaters in the local area, but will not dramatically change the runoff patterns overall. The project will increase the capacity of the river to convey flood flows, in a way that is beneficial to rearing and spawning salmonids, but that poses no risk to structures, agricultural fields or mining resources. The project does not create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems to control. The project does not place housing or any other structures within a 100-year floodplain, as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map. The project does not place structures or other materials that would impede or redirect flood flows within a 100-year floodplain. The project will affect changes in hydrology and flooding, but only in the limited project area dedicated to enhancement for fish and other aquatic species. There is no risk of damage to nearby structures or enhanced flooding in the area; therefore there is no impact to hydrology or water quality. In effect, the flooding risk nearby is ameliorated by the project activities, as the natural floodplain which functions to absorb excess runoff, will be enhanced.

VII. Air Quality

	Potentially Significant Impact	Potentially Significant Unless Mitigated	Less Than Significant Impact	No Impact
Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:				
a) Conflict with or obstruct implementation of the applicable Air Quality Attainment Plan or Congestion Management Plan?	0	0	0	X
b) Violate any stationary source air quality standard or contribute to an existing or projected air quality violation?	0	0	X	0
c) Result in a net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	0	0	X	0
d) Create or contribute to a non-stationary source "hot spot" (primarily carbon monoxide)?	0	0	0	X
e) Expose sensitive receptors to substantial pollutant concentrations?	0	0	0	X
f) Create objectionable odors affecting a substantial number of people?	0	0	0	X

Discussion

The project may cause temporary changes in air quality resulting from the transportation and screening of gravel, and the use of equipment to move gravel tailings and to place gravel instream. However, these activities will all occur in the mainly rural, open space, and agricultural areas in Merced County and changes in air quality will not be excessive, but similar to ongoing work already in the area. Under the proposed project, the transportation of gravel along private access roads and the movement and placement of gravel in areas open to public recreation use [within the project site] have the potential to temporarily affect air quality, but these effects are not expected to exceed California air quality standards or persist past the short construction time window. Over the long term the project would contribute to improving air quality, as floodplain function, including native tree establishment and growth, are restored.

VIII. Transportation/Traffic

	Potentially Significant Impact	Potentially Significant Unless Mitigated	Less Than Significant Impact	No Impact
Would the project:				
a) Conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	0	0	X	0
b) Conflict with an applicable congestion management program, including but not limited to level of service standards, and travel demand measures, or other standards, established by the county congestion management agency for designated roads or highways?	0	0	X	0
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	0	0	0	X
d) Substantially increase hazards to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	0	0	0	X
e) Result in inadequate emergency access?	0	0	0	X
f) Conflict with adopted policies, plans or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?	0	0	0	X
g) Conflict with adopted policies supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	0	0	0	X

Discussion

The project is not expected to cause a substantial increase in traffic in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections), because no transport will occur outside of the project area. Construction of the proposed project will only require the use of a few pieces of heavy equipment at a time all remaining onsite. Gravel will be processed onsite and moved to gravel augmentation areas within the project area. The project will not affect air traffic patterns because there are no airports or airstrips located within two miles of the project area. The project will have no impact on intersections or cause interruption with other uses (e.g., farm equipment). Gravel movement will be in a limited area within MRR as the gravel processing will occur onsite, and gravel will then be moved to augmentation areas inchannel. The project is not anticipated to create any roadway safety hazards. The project will not result in inadequate emergency access. The project will not impact parking capacity. The project has no impact on policies supporting alternative transportation (e.g., bus turnouts, bicycle racks). A small increase in traffic will occur during the construction activities as equipment is moved to the staging area; and, increased traffic at the Cuneo fishing access may also occur as a result of successful project implementation, but is not expected to surpass the sites' capacity. It is not expected that these increases would conflict in any way with usage for emergency or other measures.

IX. Biological Resources

	Potentially Significant Impact	Potentially Significant Unless Mitigated	Less Than Significant Impact	No Impact
Would the project:				
a) Adversely impact, either directly or through habitat modifications, any endangered, rare, or threatened species, as listed in Title 14 of the California Code of Regulations (sections 670.2 or 670.5) or in Title 50, Code of Federal Regulations (sections 17.11 or 17.12)?	0	X	0	0
b) Have a substantial adverse impact, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	0	0	X	0
c) Have a substantial adverse impact on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US Fish and Wildlife Service?	0	0	X	0
d) Adversely impact federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) either individually or in combination with the known or probable impacts of other activities through direct removal, filling, hydrological interruption, or other means?	0	0	X	0
e) Interfere substantially with the movement of any resident or migratory fish or wildlife species or with established resident or migratory wildlife corridors, or impede the use of wildlife nursery sites?	0	0	X	0
f) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	0	0	0	X
g) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Conservation Community Plan, or other approved local, regional, or state habitat conservation plan?	0	0	0	X

Discussion

With implementation of mitigation measures, the project would not adversely impact, either directly or through habitat modifications, any endangered, rare, or threatened species, as listed in Title 14 of the California Code of Regulations (sections 670.2 or 670.5) or in Title 50, Code of Federal Regulations (sections 17.11 or 17.12). Project activities will enhance habitat for juvenile and adult Chinook salmon and steelhead, both listed species under California code. Riparian habitat along the Merced River has been substantially affected by flow regulation, agricultural

and mining activities, water diversions, and changes in water quality. Floodplain and riparian habitats support juvenile salmonids by providing productive shallow water habitat and refugia from predation. The proposed project will not have a substantial adverse effect on riparian habitat or other sensitive natural community. The project would not have a substantial adverse impact, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the CDFG or USFWS. Habitat conditions would be improved for special status species with project activities.

The project would not have a substantial adverse impact on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the CDFG or USFWS. Riparian habitat will be improved through project activities.

The project would not adversely impact federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) either individually or in combination with the known or probable impacts of other activities through direct removal, filling, hydrological interruption, or other means. The project activities will enhance floodplain wetland function in the Merced River.

The project would not interfere substantially with the movement of any resident or migratory fish or wildlife species or with established resident or migratory wildlife corridors, or impede the use of wildlife nursery sites. Disturbances to the movement of native fish and wildlife species because of the presence of ground-disturbing equipment and resulting noise during operations will be minor and temporary and are not expected to substantially obstruct animal movements. Stockpiles of gravel may impact certain species, but considering the landscape characteristics in the DTR, this impact is not expected to be significant. Most of the potential disturbance is during construction activities, and temporary impacts, there will be no long-term effect on dispersal or movements. The project would improve habitat connectivity for migratory fishes including Chinook salmon and steelhead. Floodplain habitat improvements due to this project may positively affect a range of species, as floodplain function is being restored.

The project does not conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance, because the project improves riparian habitat and includes planting of native vegetation.

The project does not conflict with the provisions of an adopted Habitat Conservation Plan, Natural Conservation Community Plan, or other approved local, regional, or state habitat conservation plan. The project activities improve floodplain and instream habitat, and thus contribute to local and regional habitat conservation plans. Effects of gravel transport and placement on wildlife, vegetation, and fisheries resources within the project area will be minor and temporary. The placement of gravel is beneficial to listed steelhead and fall-run Chinook salmon. Mitigation measures are included to mitigate for the temporary effects on special status species from the construction activities. All construction activities will occur outside of the critical periods for sensitive species. Stockpiles will be located outside of the active channel and floodplain, in a location where the impact to local plants and wildlife is insignificant.

X. Mineral Resources

	Potentially Significant Impact	Potentially Significant Unless Mitigated	Less Than Significant Impact	No Impact
Would the project:				
a) Result in the loss of availability of a known mineral resource classified MRZ-2 by the State Geologist that would be of value to the region and the residents of the state?	0	0	0	X
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	0	0	0	X

Discussion

The project does not result in the loss of availability of a known mineral resource classified MRZ-2 by the State Geologist that would be of value to the region and the residents of the state. The project does not result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan. The proposed project would not have an adverse impact on mineral resources for the reasons stated above. The project area was acquired in 1998 by CDFG for the specific purpose of restoring the area to benefit fish and other biological resources (CDFG 1998).

XI. Hazards and Hazardous Materials

	Potentially Significant Impact	Potentially Significant Unless Mitigated	Less Than Significant Impact	No Impact
Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	0	0	0	X
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the likely release of hazardous materials into the environment?	0	0	0	X
c) Reasonably be anticipated to emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	0	0	0	X
d) Is the project located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	0	0	0	X
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	0	0	0	X
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	0	0	0	X
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	0	0	0	X
h) Expose people or structures to the risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	0	0	0	X

Discussion

The equipment necessary for gravel movement and placement require fuel, oil and equivalent substances to operate. There is a less than significant risk of fire, explosion, or release of hazardous substances because all state and federal regulations concerning hazardous materials and health and safety will be followed. No unregulated hazardous substances are used as part of the project. The project does not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials. The project does not create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the likely release of hazardous materials into the environment. The project area is not within one-quarter mile of an existing or proposed school; therefore, the project is not reasonably anticipated to emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school. The project site in not located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would not create a significant hazard to the public or the environment. The project area is not located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport. The project would not result in a safety hazard for people residing or working in the project area. The project is not located within the vicinity of a private airstrip. The project does not impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan. The project does not expose people or structures to the risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands. The project is located in a rural area of Merced County, and there is little risk of hazardous materials escaping into the environment due to project activities. The project would have no impact on hazards and hazardous materials.

XII. Noise

	Potentially Significant Impact	Potentially Significant Unless Mitigated	Less Than Significant Impact	No Impact
Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	0	0	X	0
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	0	0	X	0
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	0	0	0	X
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	0	0	0	X
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	0	0	0	X
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	0	0	0	X

Discussion

The project will support a temporary increase in noise levels, as the gravel is removed from the floodplain and processed on the site. These noise levels will be higher than the current ambient noise levels in the area, but will be temporary in nature and not excessive. Few individuals will be impacted by the change in noise, as the area is mostly rural and there are limited numbers of individuals and businesses in the immediate project area. There is not a public airport within two miles of the project area. The project is not within the vicinity of a private airstrip. The proposed project would have a limited and temporary impact on noise levels in the immediate area, but little impact to surrounding people and businesses for the reasons stated above. The project will implement mitigation measures to insure any changes in noise level do not have a significant impact.

XIII. Public Services

	Potentially Significant Impact	Potentially Significant Unless Mitigated	Less Than Significant Impact	No Impact
Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:				
a) Fire protection?	0	0	0	X
b) Police protection?	0	0	0	X
c) Schools?	0	0	0	X
d) Parks?	0	0	0	X
e) Other public facilities?	0	0	0	X

Discussion

The project has no impact on fire protection for the area. The project has no impact on police protection for the area. The project has no impact on schools in the area. The project may contribute to increasing the extent of a local park, the Cuneo fishing access site, and thus increasing the recreational potential in the area. The project has no impact on any other public facilities. The project has no impact on public services, other than the potential enhancement of a fishing access site, and improvement of the river environment.

XIV. Utilities and Service Systems

	Potentially Significant Impact	Potentially Significant Unless Mitigated	Less Than Significant Impact	No Impact
Would the project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	0	0	X	0
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	0	0	0	X
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	0	0	0	X
d) Are sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	0	0	0	X
e) Has the wastewater treatment provider which serves or may serve the project determined that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	0	0	0	X
f) Is the project served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	0	0	0	X

Discussion

The project does not impact and would not exceed wastewater treatment requirements of the Central Valley Regional Water Quality Control Board. The proposed project will comply with Section 401 of the Clean Water Act and obtain certification from the Regional Water Quality Control Board the project-related activities will maintain water quality at the project site, and downstream. The impact is considered less than significant. The project does not require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects. The project does not require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects. The project does not require wastewater treatment or a landfill. The project has no impact on utilities and service systems.

	Potentially Significant Impact	Potentially Significant Unless Mitigated	Less Than Significant Impact	No Impact
XV. Aesthetics				
Would the project:				
a) Have a substantial adverse effect on a scenic vista?	0	0	0	X
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	0	0	0	X
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	0	0	X	0
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	0	0	0	X

Discussion

The proposed project would not affect a scenic vista as defined by the state of California. The proposed project is not in the viewshed of a scenic highway as defined by the state of California. Temporary changes in visual resources would result from the transportation and screening of gravel at the processing plant, and use of equipment to move gravel tailings and place gravel instream in mainly rural, open space, and agricultural areas of Merced County. Under the proposed project, the movement of gravel within the project site and the movement and placement of gravel in areas open to public recreation use have the potential to temporarily affect views from rural residences and public recreation areas. However, viewer exposure would be low to moderate depending on location of viewers. Furthermore, because impacts would be relatively short term and temporary, impacts on visual resources are considered less than significant. The project site has limited visibility to the general public, with limited viewing from recreational river users. The proposed project would not create a new source of light or glare; therefore, the project would not adversely affect day or nighttime views.

XVI. Cultural Resources

	Potentially Significant Impact	Potentially Significant Unless Mitigated	Less Than Significant Impact	No Impact
Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource which is either listed or eligible for listing on the National Register of Historic Places, the California Register of Historic Resources, or a local register of historic resources?	0	0	0	X
b) Cause a substantial adverse change in the significance of a unique archaeological resources (i.e., an artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it	0	0	0	X
c) Contains information needed to answer important scientific research questions, has a special and particular quality such as being the oldest or best available example of its type, or is directly associated with a scientifically recognized important prehistoric or historic event or person)?	0	0	0	X
d) Disturb or destroy a unique paleontological resource or site?	0	0	0	X
e) Disturb any human remains, including those interred outside of formal cemeteries?	0	0	0	X

Discussion

As part of the preparation for this project, a cultural resource study was conducted in 2006 (URS 2006b). Impacts to cultural resources are considered if the resource is "significant" or "important" or "unique archaeological resource" under the provisions of CEQA Sections 15064.5 and 15126.4. There were no previously recorded cultural resources identified within the project area of potential effect (URS 2006b), and thus impacts are not anticipated. Impacts to previously unknown resources could occur during project activities; however mitigation procedures will be employed to prevent a potential impact. If any objects of cultural significance are unearthed during the construction process, work will be halted until a qualified archeologist can assess the significance of the new find (Mitigation Measure 13). If human remains are unearthed during the construction process, the project team will comply with the California Health and Safety Code Section 7050.5, which states that no further disturbance shall occur until the County Coroner has investigated the situation following the Public Resource Code Section 5097.98.

XVII. Recreation

Would the project:

	Potentially Significant Impact	Potentially Significant Unless Mitigated	Less Than Significant Impact	No Impact
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	0	0	0	X
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	0	0	0	X

Discussion

The project does not contribute to an increase in the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated. The project does not require the construction of recreational facilities.

XVIII. Mandatory Findings of Significance	Potentially Significant Impact	Potentially Significant Unless Mitigated	Less Than Significant Impact	No Impact
Would the project:				
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	0	0	0	X
b) Does the project have the potential to achieve short-term, to the disadvantage of long-term, environmental goals?	0	0	0	X
c) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	0	0	0	X
d) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	0	0	0	X

Discussion

The project does not have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory. In contrast, the project is designed to enhance fish and wildlife species by recovering a functional river landscape. The project will also work to reduce the extent of non-native vegetation with a revegetation and monitoring program. Mitigation measures have been included to reduce all potential project impacts to less than significant. The project will result in short-term impacts from construction related activities. The cumulative impacts from the project are less than significant. The impacts of the project will work to improve the environmental conditions in the area by recovering functioning floodplain habitat.

COMMENTS

State of California
Department of Fish and Game

Memorandum

Flex your POWER

Date: June 24, 2010

To: Brian Smith, Acting District Chief
Department of Water Resources
South Central Region Office
3374 East Shields Avenue
Fresno, California 93726-6913

From: Jeffrey R. Single, Ph.D., Regional Manager JRS
Department of Fish and Game
Central Region

Subject: Department of Water Resources Comments on the Merced River Ranch Floodplain Restoration Project (Project) Environmental Assessment/Initial Study
SCH No. 2010041098

The Department of Fish and Game (CDFG) has reviewed your comment letter on the above Project. To address your comments, we are providing the following additional information about the proposed Project:

1. Comment: "Figure 1 does not clearly identify the location of the project, other facilities, nor does it identify the river. It is not clearly identified as to the elevation that the floodplain will be restored to at the end of the 5 years. *Figure* 9 identifies a cut notch, but this is not defined in the project description. It is stated that 56,000 yd^3 of material will be placed in the spawning channel. Is this total over the 5 years or each Year? Also, at the bottom of the same page, *page* 15, it is stated that 53,000 yd will be placed. This is inconsistent with the 56,000 yd^3. Construction is stated to occur over a 4-6 week period for 5 years, but in some sections the impacts are based on a 2 week construction time-frame. In reading the project description, it seems that most of the mitigation measures are actually incorporated into the project description and not true mitigation. In reading the project description, it seems that most of the mitigation measures are actually incorporated into the project description and not true mitigation."

   Response: Figure 1 orients the reader and gives the location of the Project on a regional map (California Environmental Quality Act (CEQA) Guidelines Section 15124). Figure 1 is cited in the text which indicates the location of the Project is along the stretch of the lower Merced River between river mile (RM) 50 and 51, approximately 1 mile downstream of Crocker-Huffman Dam facility, and adjacent

to the Cuneo Fishing Access Site. Figure 5 is included in Section 2: Project Description which gives the precise location and boundaries of the proposed Project (CEQA Guidelines Section 15124).

There is no Figure 9 in the document. However, Section 1.3: Project Setting and Location cites Figure 5 and describes restoration activities, include removing piles of tailings from two areas of the floodplain in order to restore elevation and side channel connectivity; and, augmenting in-channel gravel supplies with properly-sized, processed material from the floodplain. The cut notch location is the side channel created by cutting a notch through dike material to reconnect a remnant side channel to increase in-channel habitat complexity to improve aquatic habitat for native aquatic species.

ERRATA will be included in an attachment to the document for clarification stating:

> "56,000 yd^3 is the total amount of material to be placed in the spawning channel over a 5-year phased construction period. There is a correction for the bottom of page 15 which states that 53,000 yd^3 will be placed; this should read 56,000 yd^3."

The entire construction period may be four to six weeks per year, but it is anticipated that two to three weeks of that time would be in preparation, material processing, and cleanup –activities that do not have the potential to impact species in contrast to placing material in the river or excavating floodplain.

While we incorporated an approach that minimized environmental impacts into the Project description, all those measures were also specified as mitigation measures in the document to insure that those measures are enforceable and implemented.

2. Comment: "In describing Mitigation Measure 1, can the number and location of trees be provided? Is the equipment cleaning and reference to New Zealand Mudsnails all part of this same mitigation measure?"

   Response: Trees will be avoided. Mitigation Measure #1 pertaining to trees has been removed but the language refers to the potential need to replace trees removed during construction activity, however all efforts will be made to avoid trees. The Project plan has been designed so that no trees will be removed unless completely unavoidable. As part of the vegetation characteristics a description of the types of trees that are on the property will be available. In the unforeseeable event that trees are impacted, the Mitigation Measure #1 outlines

the replacement ratios. We will also include identification and location of any trees removed as part of the Project. Our restoration monitoring program will also continue to monitor vegetation conditions at the site for three years post-Project and annual reports will be provided.

Equipment cleaning and measures to reduce the transmission of New Zealand mudsnails are Project components. These measures are included in all our restoration and monitoring projects to lessen impacts research and monitoring may have on the local environment. Simple steps can be taken to reduce transmission of non-native plants and animals, and these steps are best integrated into project activities.

3. Comment: "There is a description about the Best Management Practices (BMP) included in page 17 and then they are referred to as mitigation measures. This is confusing in the impact determination."

   Response: The Project established requirements or conditions on Project design, construction, and/or operation in order to protect or enhance the environment. Best Management Practices were included in the Project description providing methods or techniques found to be the most effective and practical means in achieving an objective (such as preventing or minimizing pollution) while making the optimum use of the project's resources.

4. Comment: "A detailed monitoring program is mentioned on page 19. When will this be drafted? Can you identify the native plant source and estimate the type of habitat that will be replaced?"

   Response: A detailed monitoring program draft is currently under review and will be available shortly. As noted in the document on page 19, a detailed monitoring program will outline methods objectives and approach to document the pre-Project conditions, restoration and the effectiveness of the project at recovering suitable conditions for juvenile and adult salmonids, and the expected natural recruitment of restored floodplain areas with native riparian vegetation communities. We will be happy to share that report which will provide ample information.

5. Comment: "The Reclamation Board is now the Central Valley Flood Protection Board" (page 23).

   Response: ERRATA will be included in an attachment to the document for clarification stating:

"The Reclamation Board is now referred to as Central Valley Flood Protection Board".

6. Comment: "Section 4.1 discusses the surface water and hydrology. However, the affected environment section discusses land use planning, not hydrology."

   Response: For clarification, Section 4.1.1 describes the surface water and hydrology in the affected area as being approximately 6,500 feet (approximately 2,000 meters) reach of the lower Merced River just below Crocker-Huffman Dam at the Merced River Ranch (MRR) site. Gravels will be excavated from dredger tailings piles on the river banks, sorted and processed on-site, and then placed in the main channel to improve rearing and spawning habitat for juvenile salmonids. The remaining text does refer to land use planning and resource management issues dependent on surface waters which could have an effect at a later date but not related to the project.

   Section 4.1.3.2 describes how the Project will affect the hydrology. The proposed Project would have no impact on surface water flows or groundwater availability or use. Philip Williams and Associates (PWA) used the HEC-2 to model and compare flood patterns with and without the Project surface elevation changes. They concluded that the proposed habitat work would have no impact on the designated floodway. In the Environmental Assessment/Initial Study, page 71 contains relevant discussion of Hydrology and Water Quality as well as Mitigation Measure #2 located on page 17 which addresses the potentially significant impacts of water quality and waste discharge unless mitigated. Implementation of the Project will not violate regional water quality objectives for inland surface waters.

7. Comment: "The air quality section on page 29 states that the proposed project without mitigation would have effects on air quality. However, in the checklist on page 73, all boxes are marked less than significant or no impact."

   Response: ERRATA will be included in the document for clarification stating:

   "There is a correction on page 73. Box b) and c) should indicate significant unless mitigated. Mitigation measures #5 and #6 are included on page 29, but the boxes in the checklist were not checked correctly. The document indicates project related construction activities will result in temporary adverse impacts to air quality. These effects are not expected to exceed California air quality standards or persist past the short construction time window, and because the best available air quality control

technologies, dust reduction measures, and Best Management Practices will be implemented during project construction, air quality impacts are considered less than significant with mitigation. Over the long term the project would contribute to improving air quality, as floodplain function, and native tree establishment and growth are restored."

8. Comment: "In Section 4.4.1.3.2, it is stated that there will be no impacts to riparian areas, but there is a mitigation measure 1 for removal of trees and shrubs."

   Response: For clarification in Section 4.4.1.3.2: The proposed Project work is designed not to impact riparian areas and will in all possible cases work around existing trees. A mitigation measure is included to address the unexpected event of necessary impacts to existing vegetation, and describe what measures will be taken by the Project to reduce that impact to less than significant levels.

9. Comment: "You should be able to incorporate some minimization and avoidance measures for Western Pond Turtles (page 42)."

   Response: ERRATA will be included in the document for clarification and the following language added for Western Pond Turtles on page 42.

   "Although no sensitive-status wildlife species were observed during site survey work, riparian corridor, wetlands, and dredge ponds could provide potential foraging and breeding habitat for the pond turtle. Potential impacts from construction will be minimized as work is scheduled to occur outside the March 1 – August 1 nesting season, and a pre-construction survey will be conducted to look for evidence of turtles and other wildlife, and remove any individuals encountered to comparable habitat. Wetlands and dredge ponds will be avoided. In addition, the 318 acre property is owned and protected by CDFG, potential management actions for the area include designation as an ecological reserve. This project will improve habitat conditions in the aquatic and associated upland ecosystems, and provide the pond turtle with a permanent sanctuary. This project is similar to the conservation actions for the pond turtle outlined in the Multi-Species Conservation Strategy for the CALFED Bay Delta Program (CALFED Bay Delta Final Programmatic EIS/EIR Technical Appendix July 2000)"

10. Comment: "There needs to be a reference to a mitigation or avoidance measure for reducing impacts to elderberries (page 48)."

    Response: Mitigation measures for native vegetation and elderberries were identified in Section 2 of the discussion about construction activities. Although trees will be avoided and Mitigation #1 will be removed pertaining to impacts to trees, language will remain that indicates flagging of native vegetation and Mitigation #3 indicates sensitive vegetation (e.g., native trees, elderberry shrubs) in the near vicinity of construction areas would be flagged and fenced.

    Section 4.4.3.2 Environmental Consequences indicates impacts to blue elderberry shrubs will be reduced to less than significant by implementing the described avoidance and protective measures as well as implementing the July 1999 United States Fish and Wildlife Service conservation guidelines.

11. Comment: "In Section 4.5 Recreation, it is not clear where the fishing access is located in relation to the project. Will fishing be disturbed at all by the construction activities, and will the area be accessible during the work? In the socioeconomic section it states that the Cuneo site will be accessible after the project."

    Response: Figure 1 is cited in the text which indicates the location of the Project is along the stretch of the lower Merced River between RM 50 and 51, approximately 1 mile downstream of Crocker-Huffman Dam facility, and adjacent facilities such as the Cuneo Fishing Access Site.

    Similar to other restoration projects that were constructed downstream, river kayaking, boating, and fishing could be present. For clarification, the area on the south side of the river is adjacent to a non-public levee road managed by Merced Irrigation District. On the north side of the river at the northern boundary of the property is the Cuneo public fishing access. As indicated in the document, Project activities will only occur on weekdays, because most recreational use within the Project area takes place on weekends and holidays. In addition, work hours are from 6:30 AM to 5:00 PM. Short-term impacts on recreational opportunities are likely due to construction and transport activities, which would impede use in the immediate vicinity of the construction sites and would create short-term public safety concerns for recreationers such as canoeists and anglers. If construction activities occur in areas available to public access, these areas would be temporarily restricted for public use during construction periods for safety concerns. Also, a public educational component for visitors interested in river restoration will be posted through interpretive signage with detailed information and Project progress.

For clarification, this section explains that after the Project is completed the Cuneo Fishing access will still be present and accessible.

12. Comment: "Section 4.6 Land Use should be considered separately. The affected environment doesn't truly describe socioeconomics or all land use issues (page 53). The numbering jumps to 4.5.2, and the Proposed Project description discusses noise. There is no discussion about noise other than in the Proposed Project description under socioeconomics and land use."

    Response: The Socioeconomic Conditions and Land Use is a similar to sections contained in other CEQA documents. Some of the most profound changes in the landscape have arisen from direct decisions concerning land use, and these have affected both the quality of environmental resources, such as soils and water, and the sustainability of food production. Land use decisions are based on opportunities and constraints affected by both biophysical and socio-economic drivers. Socioeconomic significance is evaluated in terms of CEQA. For this Project, a significant socioeconomic impact is presumed to occur if there is a substantial impact to the following: land-use designation change; noise attenuation; displaced housing; and loss of jobs.

    ERRATA will be included in the document for clarification stating:

    > "The following language is added to the first paragraph on page 52 under Section 4.5.2.2 Proposed Project: The change in the physical environment by the project will not substantially impact the economic or social aspects of the area (CEQA guidelines Section 15064 (f)). For this project, a significant socioeconomic impact is presumed to occur if there is a substantial impact to the following: land-use designation change; noise attenuation; displaced housing; and, loss of jobs.

    The current zoning, A-2, exclusively agriculture, will not change. This Project will not impact existing agricultural parcels. Existing public access for fishing and other recreational activities at the MRR is more fully discussed in the Recreation and Public Safety section. Public access will be limited during the restoration and extraction activities; however, at a minimum, there will be a return to the access levels provided prior to the Project once theses activities are complete. This Project will use public funds on public land (the MRR is owned by CDFG) and some public access and educational opportunities will be provided once the Project is completed.

The proposed Project work is funded under the Central Valley Improvement Act Anadromous Fish Restoration Program (AFRP) and is part of the Merced River Corridor Restoration Plan (MRCRP) previously funded by the AFRP. The MRCRP is a 10-year plan aiming to restore or rehabilitate ecosystem processes in the Merced River. The annual budget for this project may be viewed each year in the AFRP Annual Work Plan(s). (Available: http://www.usbr.gov/mp/cvpia/docs_reports/awp). For fiscal year 2010, the Project budget is $295,220.

This Project will provide income to the local economy by hiring local temporary workers, and a local contractor who provide services to perform the grading and aggregate processing and placement.

Stabilizing salmonid spawning habitat may increase spawning in the river and contribute to the long-term goal of increasing natural populations of salmonids and trout in the Merced River. Restoration and increases salmonid production will have long-term economic and intrinsic community benefits. The potential increase in anadromous fish production will have a positive, long-term effect on the regional commercial and sport fishery industries as well as potentially contributing to long-term economic improvement in the local area.

13. Comment: "In Section 4.7.3.2 on page 54, within the Proposed Project description for cultural resources, it states that there are potentially significant impacts that will be mitigated to less than significant with Mitigation Measure 13; however, in the checklist on page 85, it is considered that there are no impacts. The check list is out of place and not consistent with text."

    Response: For clarification Mitigation Measure #13 is a preventive measure: The checklist is correct. As part of the preparation for this Project, a cultural resource study was conducted in 2006. There were no previously recorded cultural resources identified within the Project area of potential effect and a Sacred Lands file check came back with negative results. However, if any objects of cultural significance are unearthed during the construction process then we included a preventive measure such as work will be halted until a qualified archaeologist can assess the significance of the new find.

14. Comment: "The Greenhouse Gas Emissions section on page 70, should at least refer to SB 32 and try to estimate the emissions due to the project using table 3 and estimating transportation of the employees to the site. Estimate carbon emissions to help prove it is not significant. The project duration, according to the project description, is not 2 weeks, but 5-6 weeks over 5 years. Refer to the enclosed page for further information on Greenhouse Gas emissions. The checklist is not consistent with the text."

Response: There is no Senate Bill (SB) 32. The primary legislative initiatives are Assembly Bill 32 (Statues of 2006), SB 375 (Statutes of 2007), and SB 97 (Statutes of 2007). Senate Bill 97 (Chapter 185, 2007) required the Governor's Office of Planning and Research (OPR) to develop recommended amendments to the CEQA Guidelines for the mitigation of greenhouse gas emissions or the effects of greenhouse gas emissions.

No comments were received during the public comment period from the California Air Resources Board. However, we have determined that we meet the measures identified in CEQA Guidelines Section 15126.4 and have addressed potential significant effects of greenhouse gas emissions. Reductions in emissions resulting from the Project will be done through implementation of Project features, Project design, or other measures, such as the use of a very limited number of vehicles as listed on Table 3, and the estimated total number of hours per year per vehicle of 300 hours. Few residences and no sensitive receptors are located nearby. In addition, Project implementation has the potential to reduce greenhouse gases, by returning ecosystem function to the side channel and floodplain that include sequestration of carbon. The United States Department of Energy Terrresterial Sequestration Research Program reported that vegetation and soils are widely recognized as carbon storage sinks. Enhancing the natural processes that remove carbon dioxide (CO2) from the atmoshpere is thought to be one of the most cost-effective means of reducing atmospheric levels of CO2. There are two fundamental approaches to sequestering carbon in terresterial ecosystems: 1) protection of ecosystems that store carbon so that carbon stores can be maintained or increased; 2) manipulation of ecosytems to increase carbon sequestration beyond current conditions.

ERRATA will be included in the document for clarification stating:

> "On page 70 in the Greenhouse Emissions discussion, there is a correction: 2 weeks should be changed to 5 – 6 weeks. All reduction measures mentioned will be implemented, and this does not change the level of significance."

15. Comment: "Hydrology/Water Quality: Hydrology/water quality is potentially significant, unless mitigated box checked. Then it is not described how it will be mitigated to less than significant. (Refer to Mitigation Measure)."

    Response: Page 71 contains relevant discussion of Hydrology and Water Quality as well as Mitigation Measure #2 located on page 17 which addresses the potentially significant impacts of water quality and waste discharge unless mitigated. Implementation of the Project will not violate regional water quality objectives for inland surface waters.

ERRATA will be included in the document for clarification stating:

> "Add mitigation measure #2 identified on page 17 to the VI: Hydrology and Water Quality Discussion page 71."

16. Comment: "Air Quality: Air Quality - letter a) should be impacted unless mitigated, according to the document. Under the Biological discussion, it is stated that with measures it would not adversely impacted. What are those measures? They need to be referred to by number."

    Response: For clarification, the word mitigation was meant to indicate our use of preventative measures designed into the Project such as Best Management Practices. The document indicated Best Management Practices will be implemented to address air quality and traffic. These are included on page 17, and they are referred to as mitigation measures. Also, the Project is designed to implement Basic Air Quality Control Measures at the Project site, including, but not limited to, watering dirt roads and construction areas. And gravel plant and loader equipment operation would be limited to Monday through Friday, except holidays, from 6:30 AM to 5:00 PM to reduce public exposure.

    ERRATA will be included in the document for clarification stating:

    > "On page 73 Section VII: Air Quality Hydrology Discussion add the following text:
    > 'The project was designed to implement Best Management Practices to address potential air quality impacts. As well as Basic Air Quality Control Measures at the project site, including, but not limited to, watering dirt roads and construction areas. Gravel plant and loader equipment operation would be limited to Monday through Friday, except holidays, from 6:30 AM to 5:00 PM to reduce potential public exposure.'"

17. Comment: "Need to have either BMPs or other measures in place to avoid potential emissions of fuel or hazardous materials into the river."

    Response: The document indicates all equipment will be clean and use biodegradable, vegetable-based lubricants and hydraulic fluids. Construction specifications would require that any equipment used in or near the river to be properly cleaned to prevent any potentially hazardous materials from entering the river, and containment material would be on-site in case of an accident. Contracted construction personnel would

regularly monitor work to insure environmental compliance. Best Management Practices are expected to be in place as well as the BMPs identified during the permitting process. In addition under Mitigation Measure #2, all equipment working within the stream channel would be inspected daily for fuel, lubrication, and coolant leaks; and, for leak potentials (e.g., cracked hoses, loose filling caps, stripped drain plugs, etc.). Furthermore, all equipment would be steam cleaned prior to working within the stream channel to remove contaminants that may enter the river and adjacent lands; and, vehicles are to be fueled and lubricated in a designated staging area located outside the stream channel and banks. Spill prevention kits will be located close to construction areas, with workers trained in its use.

In summary, the new information that is added in response to your comments merely clarifies, amplifies, and represents insignificant modifications to the Draft Environmental Assessment/Initial Study (CEQA Guidelines Section 15073.5). As a result, an ERRATA will be included in the front of the document for clarification purposes. This does not change the analysis and conclusions in the Draft Environmental Assessment/Initial Study. We appreciate your input on our Project, and if there are any additional questions, please contact Patricia Brantley, Staff Environmental Scientist, at (209) 772-0703.

Enclosure

cc: Department of Fish and Game
Dean Marston
Julie Vance
Gerald Hatler
Tim Heyne

Merced River Ranch

Restoration Monitoring Program

Prepared by:

Cramer Fish Sciences

In Collaboration with:

Anadromous Fish Restoration Program

California Department of Fish and Game

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SUMMARY

The following document is intended to provide a detailed description of the monitoring program associated with the Merced River Ranch Floodplain Restoration Project. In 1998, the California Department of Fish and Game (CDFG) acquired the Merced River Ranch (MRR) with the goals of protecting riparian habitat, improving conditions for salmonids, and supporting public access. The project is funded by the U.S. Fish and Wildlife Service (USFWS) Anadromous Fish Restoration Program (AFRP). After many years of researching and planning for various aspects of the project, a final draft design has been completed and the implementation permitting process has begun as of January 2010. Project actions are expected to rehabilitate floodplain habitat in the lower Merced River below Crocker-Huffman Dam, and conduct detailed implementation, effectiveness, and validation monitoring to collect robust data for assessing project success based on target objectives and parameters, and inform similar habitat restoration efforts in the Central Valley.

The monitoring program consists of three conceptual approaches to monitoring: implementation, effectiveness, and validation. The implementation monitoring will determine if the project was installed according to the design standards. Hydrology, topography/bathymetry, sediment budget and vegetation will be assessed. The central question is: Was the project implemented according to plan? The effectiveness monitoring will determine if the project was effective in recovering habitat conditions suitable to target species. A range of physical and biological traits will be tracked before and after restoration to assess ecosystem function. The central question of effectiveness monitoring is: Was the project effective in meeting its target objectives? The final part of the monitoring program will determine if floodplain restoration projects, like the one at MRR, recover *productive* habitat for salmonids and riparian vegetation. This validation monitoring is intended to validate the underlying assumptions of the restoration work. The central question of validation monitoring is: Are the basic assumptions behind the project conceptual model valid? This monitoring program will collect detailed physical and biological information for evaluation. This evaluation may improve our understanding of restored ecosystem function at the MRR and the potential of side channel and floodplain river restoration projects to contribute to improved salmonid populations.

The following monitoring program has been adapted from the Technical Memorandum #9 Merced River Ranch Channel-Floodplain Restoration: Post-Implementation Monitoring Plan (Stillwater Sciences 2006). Metrics outlined in this plan have been consolidated and revised to better fit the project's target objectives and the focus of AFRP and to make use of some of the newest tools available in ecosystem science. The monitoring program for this project has been developed specifically to test hypotheses about habitat recovery processes. Several authors have noted the utility of designing restoration projects as experiments to test hypotheses regarding the physical and biological responses to restoration actions, and to develop a better understanding of process-based approaches in restoration science (Simenstad and Thom 1996; Roni et al. 2005; Merz and Moyle 2006). In order to understand the cause and effect relationships in restoring system processes, both effectiveness and validation monitoring are needed to learn from both failures and successes (Roni et al. 2005). This project integrates restoration actions, public outreach, monitoring, and adaptive management to better restore habitat in the Merced River, and provide an example for other Central Valley rivers.

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INTRODUCTION

In 1998, the California Department of Fish and Game (CDFG) acquired the Merced River Ranch (MRR) with the goals of protecting riparian habitat, improving conditions for salmonids, and supporting some public access. Restoration planning began with Phase I of the Merced River Corridor Restoration Plan, funded by U.S. Fish and Wildlife Service's Anadromous Fish Restoration Program (AFRP). The Merced River Stakeholders (MRS) and Technical Advisory Committee (TAC) were established during Phase I planning, and tasked with providing input throughout the duration of the project. The primary goal of Phase I was to provide a technically-sound, publicly-supported and feasible plan to restore habitat for fish populations in the lower 52 mi (84 km) of the Merced River. The plan extent is from Crocker-Huffman Dam to the confluence with the San Joaquin River, and includes the Dredger Tailings Reach (DTR) in which MRR is contained.

Phase II of the process was funded by CALFED in 1998, and consisted of baseline investigations into the geomorphic and riparian vegetation characteristics of the project reach (Stillwater Sciences 2001a). These investigations include the DTR and also identify social, institutional, and infrastructural opportunities and constraints for restoration (Stillwater Sciences and EDAW 2001). In 2000, CALFED funded Phase III that included the development of the Merced River Corridor Restoration Plan (Stillwater Sciences 2002) and a series of public workshops to present the plan and receive input from MRS, TAC, and the public.

The Restoration Plan identifies objectives and actions based on the scientific understanding of the Merced River. To guide restoration planning and address the various environmental impacts in the DTR, the Plan identified the following specific restoration objectives:

- Balance sediment supply and transport capacity to allow the accumulation and retention of salmonid spawning gravel;
- Restore floodplain functions that foster recruitment of riparian vegetation and the quality of riparian habitat;
- Increase in-channel habitat complexity to improve aquatic habitat for native aquatic species; and
- Re-engineer the low-flow and bankfull channel geometry so that it is scaled to function properly under current (regulated) flow conditions and to prevent riparian vegetation encroachment in the active channel.

From 2003-2006, Phase IV of the planning process built upon the Phase III plan with funding from the California Bay-Delta Authority (CBDA). The Phase IV objective was to design pilot floodplain and channel restoration experiments at MRR to initiate the restoration of natural ecosystem function, and to develop monitoring and evaluation plans to improve scientific understanding of the driving processes for floodplain restoration and inform future projects.

In Phase V of this work the project plan will be reviewed, revised, permitted, and implemented, building on the work of the previous phases. All actions will be carefully monitored to document implementation results, the effectiveness of the project at providing habitat for salmonids, and to validate the core assumptions of the project through controlled experiments.

All monitoring will be focused to address the goals of AFRP and to inform similar projects elsewhere in the Central Valley.

Similar work has occurred successfully on the Mokelumne River. Project objectives included providing additional salmonid spawning gravels (~1,400 yds^3 annually; ~1,940 tons), and improving inter-gravel water quality. Merz et al. (2004) showed that rehabilitated sites produce 30-35% more fry than pre-existing degraded sites. Collaborative monitoring studies also showed that improving spawning habitat improves conditions for other salmon life stages, as well as benthic macroinvertebrate production (Merz and Chan 2005). Juvenile fish were found foraging in the side channel in densities of up to 2.71 fish m^2 (Heady and Merz 2006). Wheaton et al. (2004a, b) designed and monitored gravel placements using an integrated approach that assessed the status of salmonid spawning physical habitat conditions as an indicator of ecosystem health. Through restoration monitoring, these projects demonstrated the value of habitat restoration to native salmon populations. Although few studies have established relationships between the ability of habitat to produce salmon on a watershed scale and easily measurable habitat variables (Sharma and Hilborn 2001), restoration projects provide an opportunity to explore those links. Post-project monitoring developed as part of this project will draw on previous studies to evaluate the physical and biological parameters of ecosystem health, development, and productivity, in terms of juvenile rearing, egg-to-fry survival, and river ecosystem rehabilitation.

Vision

> *To restore (i.e., rehabilitate and enhance) channel, floodplain and riparian ecosystem processes and critical habitats for juvenile and adult salmonids, in coordination with local communities and stakeholders, to promote the recovery of healthy and diverse Chinook salmon and steelhead populations in the Merced River, while helping to meet the abundance goals of the Anadromous Fish Restoration Program (AFRP)*

This vision fits into the framework of salmonid population recovery on the Merced River and is aligned with the following AFRP goals to: 1) involve local partners in the implementation and evaluation of restoration actions; 2) improve habitat for all anadromous life stages through improved physical habitat; and, 3) collect fish population, health and habitat data to facilitate evaluation of restoration actions (USFWS 2001). The vision is considered in the context of historic land use and current water management constraints and meets objectives outlined in previous planning efforts for the Merced River Ranch (Stillwater Sciences 2006).

Goals

1) To serve as an example of publicly-supported applied fisheries and restoration science;
2) To augment, rehabilitate and enhance productive juvenile salmonid rearing and adult spawning habitat in the Merced River; and,
3) To determine project effectiveness with an efficient and scientifically-robust monitoring program.

These goals fit into the framework of AFRP, and meet the AFRP and CALFED requirement to use adaptive management in planning, design, and implementation (CALFED 2001). The goals from the draft plan (CALFED ERP 02-P12-D) have been incorporated here and refined. Our

target objectives are focused on AFRP goals and meet most of the previously defined objectives from the draft plan.

Target Objectives

Realistic target objectives are an important component of our approach to clearly address project goals. Detailed actions provide the necessary steps to achieve the target objectives. Iterative review of these actions is essential to determining the reliability in each particular step to meet the parameters of the project goal. The Project Plan with the following components (i.e., Community Outreach Plan, Design Standards, and Monitoring Program) and associated target objectives were developed to meet the aforementioned project vision and goals for the Merced River Ranch (MRR) and channel and floodplain restoration project. Furthermore, the target objectives consider the following seven goals outlined in the MRR planning documents in more detail which include: 1) restoring hydrologic and hydraulic functions; 2) restoring geomorphic processes; 3) restoring and enhancing habitat for native fish, plants and other species; 4) preserving, restoring and actively managing upland habitats and native species of value; 5) facilitating management of the MRR as a long-term supply of coarse sediment for regional restoration projects; 6) improving public understanding of restoration; and, 7) facilitating improvement of public education and recreation opportunities (Stillwater Sciences 2005).

Goals 1 through 4 are addressed by the Design Standards, goal 4 is also addressed by the Monitoring Program, while goals 6 and 7 are addressed by the Community Outreach Plan and Monitoring Program. Goal 5 will not be directly addressed as part of this project, although gravel will be excavated, cleaned, sorted and stockpiled.

1) ***Community Outreach Plan (COP)****: To serve as an example of publicly-supported applied fisheries and restoration science, the project will*:

   a) provide a range of outreach opportunities to promote the value of river restoration to local community members and user groups;

   b) promote a stewardship program for the river that integrates individual projects into the framework of common visions and goals of local, state and federal endeavors;

   c) incorporate the values of the community into the project (e.g., aesthetic values, flood control, socio-economic needs of the community, etc.); and,

   d) contribute to the development of educational programs and recreational opportunities.

2) ***Design Standards****: To effectively augment, rehabilitate and enhance productive juvenile salmonid rearing and adult spawning habitat, the project will*:

   a) incorporate the project into an ecologically-sound, ecosystem context by designing the project to function under current water management constraints (i.e., magnitude and duration);

   b) reestablish channel and floodplain habitat connectivity and complexity to restore ecological processes at the proposed project site to increase the availability and maintenance of channel and floodplain habitats;

   c) create habitat conditions suitable for juvenile Chinook salmon rearing (i.e., fry and sub-yearling smolts);

d) create habitat conditions suitable for adult Chinook salmon spawning, egg incubation and development;

e) utilize existing habitat features to the maximum extent possible; and,

f) preserve and/or increase native vegetation as the dominant plant community.

3) ***Monitoring Program****: To evaluate project success by developing an efficient and scientifically-robust monitoring program to properly document implementation, determine effectiveness, and validate assumptions regarding benefits for salmonids, we will*:

a) conduct implementation monitoring to document the project was installed according to design standards and meets permitting requirements for sensitive and listed species;

b) conduct effectiveness monitoring to document ecosystem dynamics and habitat conditions with a Before-After-Control-Impact (BACI) study design; and,

c) conduct validation monitoring (i.e., experiments) to test hypotheses about the benefit of recovered river landscapes to rearing and spawning salmonids.

Monitoring Perspective

Our monitoring program will take an 'Ecosystem Perspective' as described by the Adaptive Management Forum (2002) by tracking physical and biological parameters; and the structural and functional responses by the restored ecosystem. Following suggestions from the Forum, we will consider alternative paradigms of ecosystem restoration when developing our project conceptual designs; develop an action plan to incorporate monitoring information and provide a framework for adaptive management; continue to clearly define quantifiable short- and long-term goals; and, include performance criteria to describe ecosystem function. We will ensure links in scientific input, project design, and implementation factors are intact and continuously refined.

Considerable debate about the effectiveness of restoration projects (Reeves et al. 1991; Kondolf 1995; Roni et al. 2002), in addition to the substantial investment of public funds, make it incomprehensible that monitoring is not an essential element of every restoration project (Roni and Quimby 2005). Monitoring is important to determine the environmental characteristics of a particular site. The parameters measured are critical physical and biological drivers of habitat and are intended to detect environmental change. Specific indicators (e.g., fish performance) are used that determine a value at a specific time (status), and with continued monitoring changes in the value across time at the same location (trend) can be determined. By designing monitoring programs to follow trends, the state of the system, especially restored systems, can be determined. Monitoring is critical for adaptive management (Karr and Chu 1997). Detecting and recognizing meaningful change in complex natural systems is difficult, because the systems are dynamic and heterogenous. Ecosystems maintain dynamic variation within predictable bounds (Chapin et al. 1996), but often these bounds are unknown with restoring systems.

Understanding fish use, diet composition, and ultimate success (i.e., exit Merced River) is important to determine the effectiveness of the habitat restoration. It is critical to understand if the fish are using the habitat, if the links to the prey resource are intact, and if the availability of the site contributes to the overall success of the fish in river rearing.

Efficient and scientifically-robust monitoring provides the measure of success for any restoration project, and was noted as a critical element in Phase IV. The following monitoring plan has been adapted from the Technical Memorandum #9 Merced River Ranch Channel-Floodplain Restoration: Post-Implementation Monitoring Plan (Stillwater Sciences 2006). Metrics outlined in this plan have been consolidated and revised to better fit the project's target objectives and the focus of AFRP and to make use of some of the newest tools available in ecosystem science.

Integrating with Other Monitoring Programs

This monitoring program will be designed to integrate with the other long-term monitoring occurring in the Merced River, as possible. From 2007–2009, the USFWS supported CFS to monitor juvenile salmonid out-migration in the Merced River. This monitoring program determines annual juvenile Chinook salmon and *O. mykiss* production using rotary screw traps (RSTs) at Hatfield State Park (Hatfield; rkm 3.2), and quantifies emigrants to the San Joaquin River (Watry et al. 2007, 2008). This data set is intended to provide a valuable source of information for evaluating fish responses to in-river management actions (CAMP 1997). The primary objectives of this project are: 1) estimate abundance of juvenile salmonid out-migrants in the lower Merced River using RSTs operated near Caswell; and, 2) determine and evaluate patterns of timing, size, and abundance of juveniles relative to flow and other environmental conditions. This juvenile salmon monitoring program helps AFRP and CAMP address their goals to track population dynamics, evaluate the results of past and future habitat restoration efforts, and to understand the impacts of instream flow schedules and management on the fall-run Chinook salmon population. The Merced Irrigation District (MID) has also funded ongoing juvenile salmonid population monitoring at Cressey (rkm 43.5). Natural Resource Scientists, Inc. has been conducting the monitoring effort to determine the in-river spawning success by tracking the number of fry produced. The effort also provides information about *O. mykiss* and other fish species able to be collected by RST.

Our monitoring efforts to assess habitat restoration on the Merced River may be coupled with ongoing juvenile out-migration monitoring programs. In addition to quantifying any change in population status, these monitoring efforts can potentially be used to track the success of juveniles using restored habitats. During post-project monitoring activities at restoration sites, juvenile salmonids may be collected on site, and marked during processing for other data. The collection of marked fish at Hatfield would indicate successful rearing and migration, and document the potential benefits of restored rearing habitat to the population. The size and condition of fish may also indicate improvements in rearing conditions, although a detectable signal may be difficult to obtain due to the overwhelming impact of the other limiting factors in the river. Similar protocols are being conducted in Clear Creek following floodplain rehabilitation (M. Teubert, pers. comm., 2008). Note, current population levels may make probability of recapture very small, especially if monitoring efforts are reduced or eliminated.

Adult spawning surveys are currently conducted by CDFG each fall in the Merced River. These surveys include an estimate of adult escapement based on numbers and redd surveys. Our monitoring program intends to augment these monitoring efforts by providing additional assistance in adults or redd surveys. The CDFG also has a variety of other surveys for juvenile salmonids in the lower San Joaquin and delta, which may provide additional opportunities for synergistic monitoring activities.

Active Experimentation

Monitoring of long-term project effectiveness and the implementation of comparative studies needs to be given a higher status, adequately supported, and made more effective (AMF 2004). Each restoration project is another opportunity to further the science of restoration ecology, by testing hypotheses. Restoration projects allow researchers to test theories in habitat function and apply them to restoration design (i.e., channel width, riffle/pool size, meander radius, elevation, and riparian community structure, etc.) (AMF 2004). Using active experimentation to address how well restoration projects conform to the underlying conceptual models is important (AMF 2004) and can provide supporting evidence to validate underlying assumptions about recovering habitat function with specific actions. These studies will also inform ongoing efforts to restore habitat with detailed information about recovering habitat condition and productivity. As with all monitoring activities, studies should be well-designed with clear target objectives and criteria with robust analyses of results. This restoration monitoring program takes a hypothesis-testing, science-based approach to address a series of questions about river restoration and restoring ecosystem function at the MRR. This approach follows recommendations from the CVPIA Independent Review Panel (Circlepoint 2008).

Partnering with AFRP and the Community

This monitoring program will occur with the contribution of AFRP and potentially interested community members. We anticipate AFRP staff members will assist with periodic data collections including aquatic habitat sampling, vegetation and topographic surveys. Anadromous Fish Restoration Program staff will also assist during validation experiments. We also anticipate the potential to meet interested community members at the public outreach functions who may be interested in assisting with data collection on site. Through a coordinated effort, more detailed monitoring can be accomplished and partnerships with interested parties strengthened.

APPROACH

Background

Assessment of restoration actions should include three types of monitoring: implementation; effectiveness; and validation (MacDonald et al. 1991; Kershner 1997; Mulder et al. 1999). Time scales, project aspects, and objectives addressed will vary among types of monitoring (Table 1).

Table 1. Monitoring types for the MRR restoration project (Stillwater Sciences 2006).

Type of Monitoring	Question Addressed	Time Frame
Implementation	Was the project installed as planned?	1 – 6 months
Effectiveness	Was the project effective at meeting restoration objectives?	1 year to decades
Validation	Are the basic assumptions behind the project conceptual model valid?	5 – 10 years

We are following this conceptual model for monitoring. The following outlines questions addressed as part of the three types of monitoring for the MRR project. As recommended in Phase IV, we have developed a series of experiments to test habitat function for adult and juvenile salmonids in terms of egg-to-fry survival and juvenile rearing performance, and to determine the conditions controlling native vegetation community development. The results of these experiments are expected to improve future restoration projects in the DTR, and inform fisheries scientists with a regional-level understanding of ecosystem dynamics in the Sacramento-San Joaquin watersheds. This project will provide an essential contribution to the goals of the California Bay-Delta Authority as well as others.

Implementation Monitoring

Implementation monitoring will determine if the restoration project was implemented according to the design plan, and met the goals of the project design. Generally, monitoring occurs after construction is complete, however some aspects will be carried out during implementation as a check on design appropriateness (Kershner 1997). Mid-course corrections can be made as appropriate. In addition to tracking the success of the implementation in terms of physical structure, we will also investigate the restored channel and floodplain function in terms of hydrology and flooding inundation. The frequency and duration of flooding is among the primary drivers of habitat productivity in terms of accessibility for fish, prey resource production, and habitat maintaining processes (Hill et al. 1991; Tockner et al. 2000). Projections were established during the project design planning for frequency and duration of inundation. To determine if the project was installed as planned, the following monitoring components will be addressed (Table 2):

Table 2. Implementation monitoring components (Stillwater Sciences 2006), revised.

Component	Question(s)	Parameter	Timeline
C1. *Constructed topography/bathymetry match those in project design.*	Does the constructed topography/bathymetry match design plans?	Topography and Bathymetry	During and Immediately following construction; September 2010
C2. *Inundation frequency and duration matches target objectives.*	Does duration and magnitude of flooding match design plans?	Discharge, groundwater level, flooding inundation, rate of recession	Following construction, then continuous; October 2010 – September 2013

Effectiveness Monitoring

Site-specific effectiveness monitoring will track physical conditions and biological responses necessary to provide productive rearing and spawning habitat for salmonids. Effectiveness monitoring is complex and requires evaluating the outcomes of multiple objectives relating physical, biological, and biogeochemical factors at work in the river-floodplain ecosystem (Stillwater Sciences 2006). The following parameters are among those physical parameters important for understanding function in aquatic habitats: water temperature, DO, turbidity, hyporheic flow and water quality. Documenting channel bathymetry and on-site coarse sediment supply budgets are also critical to understanding habitat function. Terrestrial parameters of the floodplain may include topography and flooding inundation. We also track the biological response in the side channel and floodplain in terms of fish use and residence, invertebrate production, fish foraging success, diet composition and potential growth, vegetation characteristics, and use the information to explore links to physical conditions.

The monitoring plan will track the physical and biological parameters closely related to each of the target objectives outlined in the project plan, and determine the effectiveness of the design in restoring target habitat conditions. In keeping with the approach of adaptive management and environmental monitoring, pre-determined metrics and success criteria are given with each target objective, and the approach is designed to test the hypotheses associated with the project. The primary question to be answered by the effectiveness monitoring is: was the project effective at meeting restoration objectives?

The following null and alternate hypotheses will be tested to determine the effectiveness of gravel augmentation, recovered side channels and seasonally inundated floodplain habitats to recovering habitat for juvenile and adult salmonids (Table 3).

Table 3. Effectiveness monitoring hypotheses, questions, and parameters measured.

Hypothesis	Question(s)	Parameters Measured	Timeline
$H1_0$: *Restoring floodplain processes in the Merced River does not result in improved habitat conditions for salmonid rearing habitat.* $H1_a$: *Restoring floodplain processes in the Merced River results in improved habitat conditions for salmonid rearing habitat.*	Are habitat conditions in project area suitable for juvenile Chinook salmon rearing? Are conditions following restoration significantly different than reference sites?	Flooding Inundation Water Velocity/Depth Water Temperature Dissolved Oxygen Turbidity Fish Surveys Macroinvertebrates	February, March 2010 – 2013 April, May 2010 – 2013
$H2_0$: *Restoring in-channel coarse sediment processes in the Merced River does not result in improved habitat conditions for salmonid spawning habitat.* $H2_a$: *Restoring in-channel coarse sediment processes in the Merced River results in improved habitat conditions for salmonid spawning habitat.*	Are habitat conditions in project area suitable for adult Chinook salmon spawning? Are conditions following restoration significantly different than reference sites?	Permeability Channel Bed Surface Composition Composition at Depth with Bulk Sampling Sediment Dynamics Spawner Surveys	October, November 2010 – 2012
$H3_0$: *Restoring floodplain processes in the Merced River does not result in improved conditions for native vegetation communities.* $H3_a$: *Restoring floodplain processes in the Merced River does result in improved conditions for native vegetation communities.*	Was there an increase in native vegetation in the project area? Was the cover of non-native invasive plant species reduced or prevented?	Photo Points Project Area Vegetation Mapping Field-Collected Vegetation Data Soil Characteristics Groundwater Level	June, July 2010 – 2013

These questions align with the target objectives for the overall project, and the following methods are for periodic and continuous tracking of those parameters outlined. By using the hypothesis testing approach and answering detailed questions associated with the project, we will be able to monitor the project's effectiveness and provide detailed information to inform ongoing restoration for salmonids throughout the Central Valley.

Validation Monitoring

As introduced in the Phase IV monitoring plan, validation monitoring is carried out to verify the underlying assumptions of the project conceptual model, and as a consequence this type of monitoring has a research focus (Kershner 1997). In Phase IV, validation monitoring focused on the responses of fish, birds, invertebrates, and riparian vegetation to the re-scaling of channel and floodplain morphology intended to match the contemporary, regulated flow regime (Stillwater Sciences 2006). In addition to documenting ecosystem responses with effectiveness monitoring, as described in Phase IV, we will conduct experiments to assess relative habitat function between the BACI sampling sites. These studies are designed to provide support to the previously stated hypotheses and to primarily address the following question: are the basic assumptions behind the project conceptual model valid (i.e., does the project contribute to increased productivity for Chinook salmon populations in the Merced River)?

We will assess benefits to spawning Chinook salmon of gravel-bed enhancement following methods outlined in Merz et al. (2004) and Wheaton et al. (2004a, b), and use a bioenergetics model to assess juvenile Chinook salmon performance in the non-restored and restored sites. The bioenergetics model is a powerful tool to assess habitat in terms of potential fish growth and has been used by other researchers aiming to assess restoration success (Brandt et al. 1992; Mason et al. 1995; Tyler and Brandt 2001; Sommer et al. 2001; Madon et al. 2001; Gray 2005). The model's energy-balance approach estimates growth as food consumed (C) minus the energetic costs of respiration (R), specific dynamic action (cost of processing a meal) (S), and wastes (egestion (F) and excretion (U)). Model inputs will include site-specific temperature, fish size, diet composition and prey energy content. The bioenergetics model (Hanson et al. 1997) is a simple, mass-balance equation that determines fish growth through established physiological relationships and those factors with the largest effect on growth: consumption rate, food composition and quality, and temperature. By evaluating modeled growth potential in foraging fish, the relative benefit of foraging in restored habitats can be quantified.

By demonstrating the benefit available to spawning and rearing fish, especially in the BACI context, the work should increase our understanding of mechanisms of channel enhancement and floodplain restoration, and the links between healthy ecosystem, hydrologic and geomorphic processes (Merz et al. 2004; Wheaton et al. 2004a, b). The following hypotheses will be tested to determine the benefit of gravel augmentation, recovered side channels and seasonally inundated floodplain habitats to juvenile and adult salmonids (Table 4).

Table 4. Validation monitoring hypotheses, questions, and parameters measured.

Hypothesis	Question(s)	Parameters Measured	Timeline
$H1_0$: Restoring floodplains in the Merced River provide no productive salmonid rearing habitat. $H1_a$: Restoring floodplains in the Merced River provides productive salmonid rearing habitat.	Does restoring floodplain processes recover productive habitat for salmonid rearing?	Juvenile Growth Potential determined with Bioenergetics Model -fish size, diet composition, consumption rate, prey energy content, and temperature conditions	February, March 2011 – 2012
$H2_0$: Restoring in-channel coarse sediment processes in the Merced River provides no productive salmonid spawning habitat. $H2_a$: Restoring in-channel coarse sediment processes in the Merced River provides productive salmonid spawning habitat.	Does restoring in-channel coarse sediment processes recover productive habitat for salmonid spawning?	In Situ Egg-to-Fry Survival with Egg Tubes -change in size and survival	October, November 2011 – 2012
$H3_0$: Restoring floodplains in the Merced River does not restore ecosystem processes that lead to an increase in native vegetation cover and complexity. $H3_a$: Restoring floodplains in the Merced River does restore ecosystem processes that lead to an increase in native vegetation cover and complexity.	Does restoring floodplains recover ecosystem processes that affect the success of natural native plant recruitment?	Flooding inundation Sediment dynamics Woody plant recruitment	June, July 2011 – 2012

Study Design

The field sampling has been designed to collect data to inform the concepts, hypotheses and questions from each type of monitoring, and address project target objectives. Monitoring efforts may occur across the entire project site (e.g., topography surveys), or be concentrated in permanent sampling plots (determined through a stratified-random sampling design). Samples will be collected before and after project implementation. The Before-After-Control-Impact (BACI) study design structure is used to test the differences between the non-restored and restored sites (Green 1979; Stillwater Sciences 2006). This approach can utilize a paired series of Control-Impact sites, subjected to a series of Before-After replicated measurements, referred to as the paired BACI design (Bernstein and Zalinski 1983; Stewart-Oaten et al. 1986; Smith 2002). Robust statistical assessment is possible because of the spatial and temporal replication.

Relevé field sampling (CNPS 2007) is used for vegetation data collection. This protocol follows methods of vegetation community sampling and mapping developed by the California Native Plant Society and CDFG to meet the standards developed by the Federal Geographic Data Committee (Jennings et al. 2009). These standards have been submitted to the State Legislature as vegetation mapping standards for California (CDFG Item 3600-001-0001). Furthermore, the San Joaquin Valley has been identified by CDFG as a high priority area for vegetation sampling, classification and mapping (CDFG 2007). The relevé provides detailed quantitative measures of vegetation structure, composition and cover dominance that are collected efficiently, analyzed statistically and accurately repeatable across time by trained personnel. It also collects habitat information per the California Wildlife-Habitat Relationships System (see http://www.dfg.ca.gov/biogeodata/cwhr/). Additionally, we will map woody stem recruitment within a gridded subplot of each relevé.

Before and after channel bathymetric and floodplain topographic surveys will document the dimensions and elevations within the project area. Additionally, topographic surveys will be conducted on an annual basis to monitor the project area and fluctuations in bed elevation resulting from sediment deposition and scour and, potentially, lateral shifts of the channel. Changes are expected as part of the natural function of the river landscape, and a better understanding between the topographic characteristics and biological function will be enabled by these data collections. Cross-section and longitudinal profile surveys will provide detailed documentation of elevations, dimensions, and forms of the main channel and floodplain.

Understanding the hydrology of the project area is essential for testing nearly all of the project hypotheses. Current hydrology will be compared with the results of the hydraulic models (developed during the planning process) to compare with predictions. Pressure transducers will also log the timing and duration of the river stage, and can therefore be related to habitat requirements for both salmonid and riparian tree species. These data can be compared with biological information on salmonids and riparian vegetation to evaluate if favorable habitat conditions for these species were achieved. Pressure transducers will also provide an important check on the actual discharge required for floodplain inundation. Groundwater wells can be installed to monitor groundwater water quality. Water quality monitoring will also be a component of regulatory monitoring during project construction and gravel augmentation activities.

We will use a variety of methods to monitor substrate characteristics and dynamics. Data will be used with bathymetric and topographic information to determine the frequency and magnitude of sediment transport in the restored reach. Substrate characteristics will be determined using pebble counts (see below) while tracer rocks and scour chains will provide information on bed mobility. Incubating embryos are affected by gravel permeability, dissolved oxygen, and gravel particle size composition (Barnard and McBain 1994). Measures of gravel permeability determine the flow of water through the channel bed material. These measurements can be directly used to calculate an index of survival-to-emergence for salmonids and can provide a rough indication of expected salmonid fry abundance (Stillwater Sciences 2006).

Relative fish abundance and diet composition will be evaluated at aquatic habitat sampling sites by multi-pass electrofish sampling (Reynolds 1996; Van Deventer & Platts 1989) and gastric lavage (Haley 1998; Koehler et al. 2006). These methods allow collection of information on densities and diet composition *without mortality*. Diet samples will be processed following

standard procedures described in Terry (1977) and Gray et al. (2002). Diet composition information may also be available (by gastric lavage) of fish obtained during the ongoing RST operations, if necessary (see below). A relative consumption rate will be determined by assessing the weight of the stomach contents to the weight of the fish (ration). Prey energy will be generalized using literature values. Several studies have suggested the use of models to assess habitat (Madon et al. 2001), or used it to assess relative conditions in a restored floodplain (Sommer et al. 2001). These data will provide critical information to address questions associated with implementation, effectiveness and validation. Our intent is to document that the project was implemented according to design plans, is effective in terms of providing habitat for riparian vegetation and salmonids, and validates project assumptions regarding the potential productivity for salmonids by restored river landscapes.

A critical component of monitoring habitat function is gathering information on the macroinvertebrate community. Invertebrates are also important indicators of ecosystem health (Kearns and Karr 1994). Macroinvertebrates are sensitive to environmental change and have been used by many studies to assess restoration success (e.g., Gray et al. 2002; Merz et al. 2004). Additionally, juvenile salmonids primarily feed on a variety of benthic macroinvertebrates and other drift insects.

Sampling Sites

Sampling sites will be stratified and randomized in the BACI context, and replicate samples will then be collected. Sampling sites will be upstream (Merced Irrigation District, MID), within (Merced River Ranch, MRR), and downstream (Snelling) of restored reaches. The following diagram depicts our basic sampling approach (Figure 1) and schematic for vegetation sampling (Figure 2). Table 3 summarizes the monitoring parameters, equipment needs, frequency, and other important aspects of the overall monitoring program.

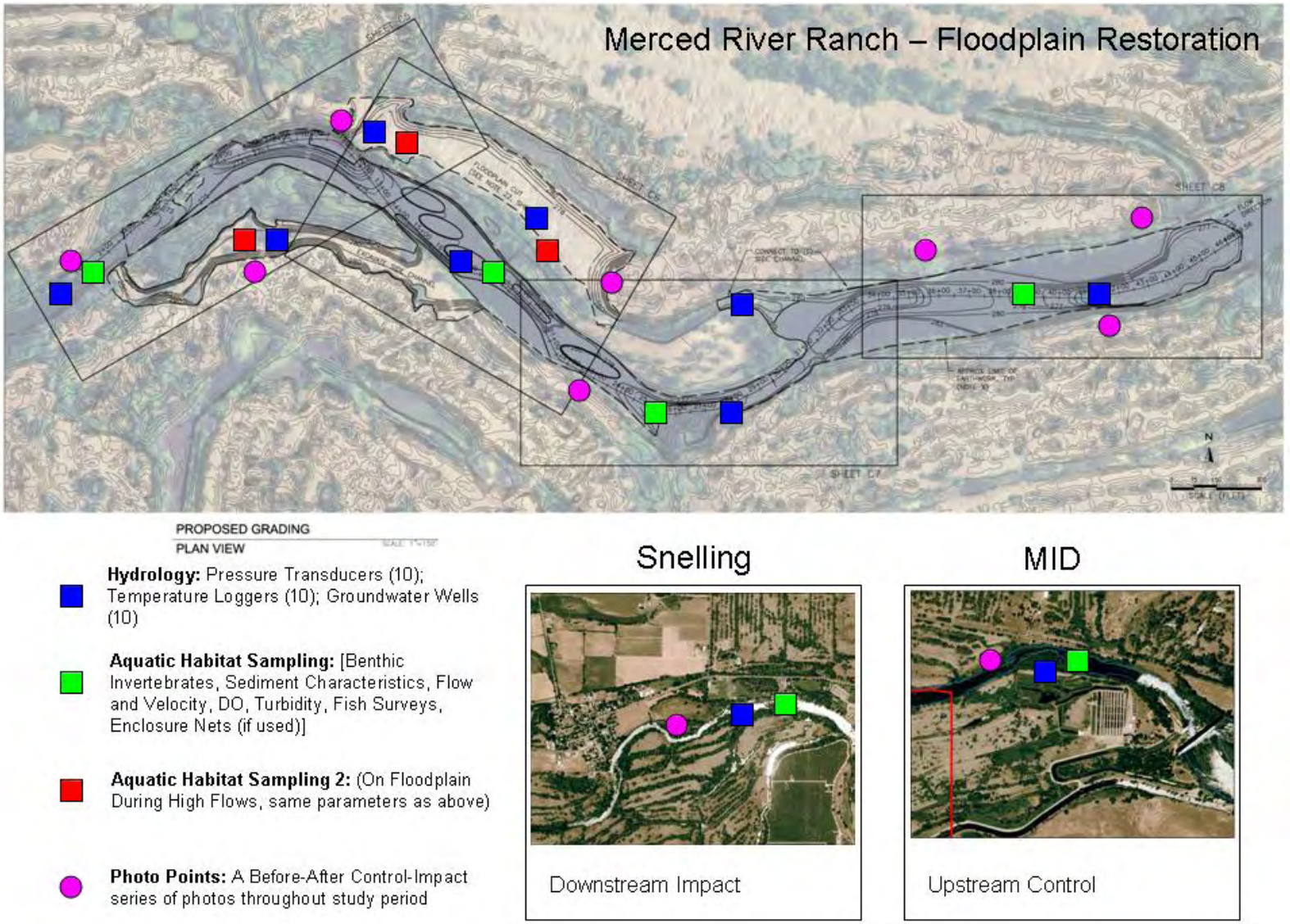

Figure 1. Merced River Ranch Project General Sampling Schematic.

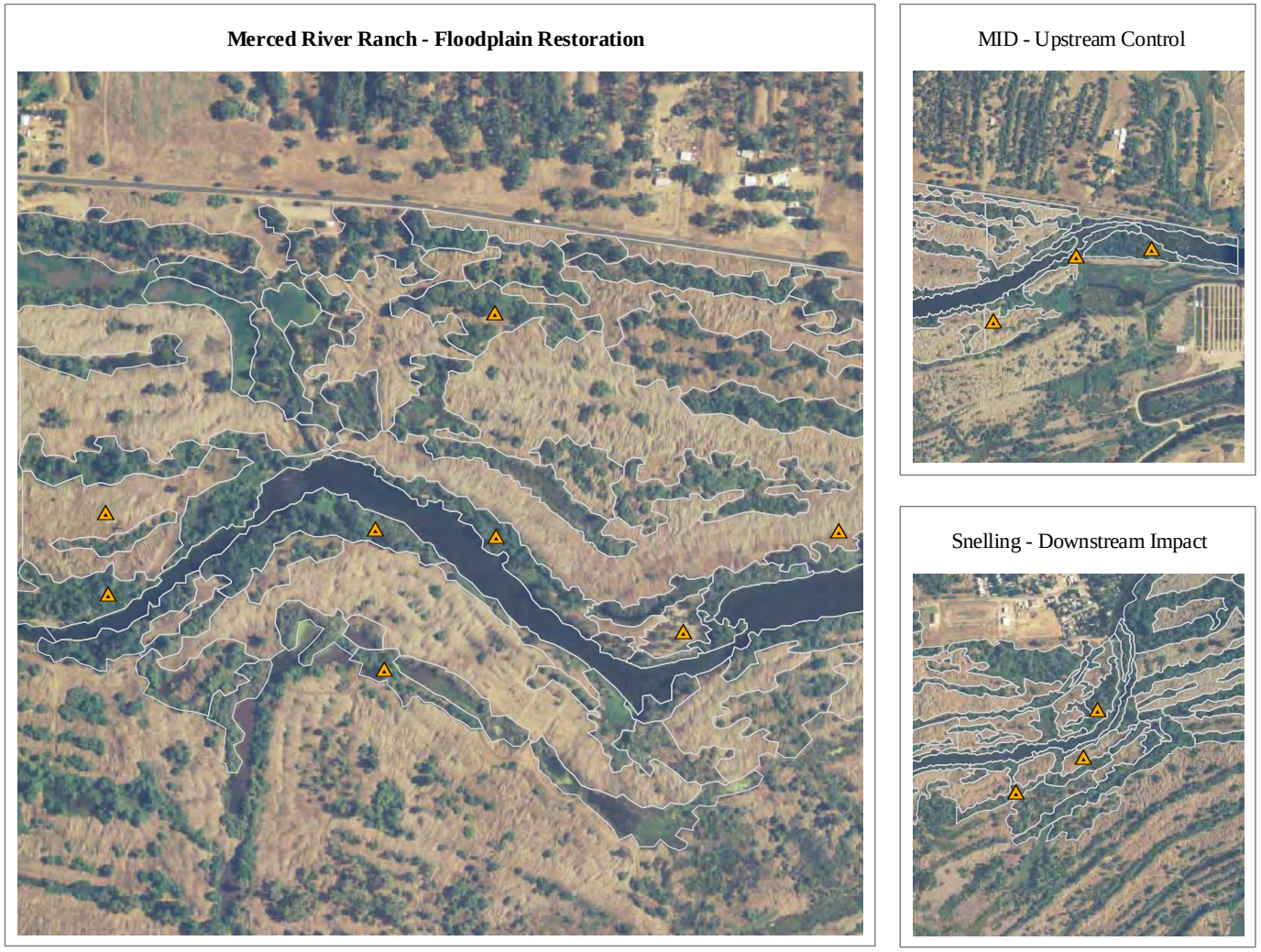

Figure 2. Merced River Ranch Project Vegetation Sampling Schematic.

Table 5. Monitoring study design and additional details.

Monitoring Parameter	Description/Use	Field Equipment	Personnel	Time Period Collected	Permitting Req	Implementation	Effectiveness	Validation
Hydrology								
Discharge	Determine outflow conditions	NA	MID	entire project period				
Flooding Inundation and Rate of Flow Recession	Determine frequency and duration of flooding events before and after restoration actions	Pressure Sensors	CFS	entire project period		X	X	
Water Velocity	Assess instantaneous habitat conditions	Flow Gauge	CFS	seasonally			X	
Water Depth	Assess instantaneous habitat conditions	Flow Gauge	CFS	seasonally			X	
Groundwater Levels	Track groundwater conditions for hydrological impacts and vegetation	YSI, turbidimeter, ??	CFS?	seasonally			x	
Topography/Bathymetry								
Topographic Surveys	Determine elevations across project site	Survey Equipment	PWA/CFS	annually		X		
Bathymetric Surveys	Determine depths in river mainstem	Sounder, etc.	PWA/CFS	annually		X		
Cross-sectional Surveys	Determine elevations at several randomlly distributed cross-sections	Survey Equipment	PWA/CFS	annually		X		
Sediment Characteristics								
Permeability	Determine level of embeddedness	Stand Pipe	CFS	seasonally			X	X
Surface Composition	Determine surface substract composition	Pebble Counts	CFS	seasonally			X	X
Sediment Dynamics	Determine sediment mobility and transfer	Tracer rocks, scour chains	CFS	seasonally			X	
Bulk Composition	Determine % fines	Bulk Sampling	CFS	annually			X	X
Water Quality								
Temperature	Assess instantaneous habitat conditions	TidBit Continuous Data Logger	CFS	continuously	X		X	X
Dissolved Oxygen	Assess instantaneous habitat conditions	DO Meter	CFS	seasonally	X		X	
Turbidity	Assess instantaneous habitat conditions	Turbidity Meter	CFS	seasonally	X		X	
Mercury Testing	Monitor potential for mercury contamination	Sampler	??	???	X	X		
Biological Conditions								
Photo Points	Document general changes in the system following restoration actions	Digitial Camera and tripod	CFS	seasonally		X	X	
Vegetation Characteristics	Track vegetation conditions in the project site and an adjacent reference	Field survey equipment	botanist	annually		X	X	X
Wildlife Surveys	Track wildlife activity and use in the project area	Binoculars, GPS	CFS	seasonally	X	X		
Fish Surveys	Determine juvenile fish presence and abundance at project site; Conduct Redd surveys using GPS; Install egg tubes; Use enclosure nets to determine site-specific fish diets and consumption rates;	Beach Seine, Electrofisher, Gastric Lavage Equipment, GPS, etc.	CFS; CDFG	seasonally		X	X	X
Prey Resource Supply	Determine prey resource availability and composition	Hess Sampler, Drift Collector	CFS	seasonally			X	X

METHODS

The following provides detailed descriptions of the methods used for the various monitoring efforts described in this program. The main objective of monitoring is to address our questions and hypotheses using sound science with targeted, efficient sampling and high quality data standards. Standard methods will be used for most monitoring activities and appropriate statistics will be applied to the results to test our hypotheses. All field activities will be conducted with qualified personnel trained in first aid and all safety precautions.

Spatial Database

Global Position System (GPS)

The CFS team will collect as much monitoring information as possible with location information using the Trimble GeoXT (GeoExplorer 2008 series). Data dictionaries will be built using the PathFinder Office™ software package to simultaneously enable easy collection of survey and location information. Data will be downloaded and post-processed immediately (within 24 – 48 hours), keeping in mind base stations are generally updated every 24 hours. Post-processed data will be checked for errors and stored with backups created periodically.

Geographic Information System (GIS)

The CFS team will use ESRI (www.esri.com) GIS to collate and summarize some of the physical and biological data collected by this monitoring program. The GIS links the spatial information obtained by GPS to photos, data tables, and other files. This spatial database system can be queried to obtain information to apply to other analyses (e.g., bioenergetics, vegetation controls, etc.). Field collected GPS data are exported into .shp files which are then opened with ArcView 9.2 software package. Exchange of data layers is facilitated by this spatial database.

Hydrology

River Discharge and Flooding Inundation

We will use discharge data from Crocker-Huffman Dam (gage operated by Merced ID) in conjunction with stage data from pressure transducers placed in the channel and floodplain of the restored reach to determine flooding inundation in terms of duration and magnitude of flows.

a) Discharge – provided by MID and summarized. On-site data also collected using flow transect method described below. Flow transect measurements will be collected at variable flows (approximately every 250 – 400 cfs) and related to on-site stage measurements to develop a site-specific flow-stage relationship.

b) Flooding Inundation (i.e., Duration and Magnitude) – a series [i.e., 10] of continually recording in-channel and floodplain pressure transducers (e.g., Onset Computer Corporation; HOBO® 30-Foot Depth Data Logger) will be used to determine magnitude and duration of inundation. Loggers will be downloaded quarterly and data summarized to evaluate flooding inundation compared with plan estimations. Locations of all pressure transducers will be recorded with sub-meter accuracy GPS.

Pressure transducers will be installed and topographically tied into five surveyed and monitored cross-sections within the MRR in the main channel. Installation of pressure transducers will be according to the manufacturer's specifications and downloads will occur periodically, or as necessary.

Water Velocity/Depth

Depth and water velocity will be measured at each sampling site before and after gravel augmentation and floodplain regrading. A Marsh-McBirney flowmeter (Flo-Mate Model 2000; Hatch Company) will be used for taking water velocity measurements at each sampling site, and depth will be measured with the top-setting wading rod. The unit uses an electromagnetic sensor to measure the velocity in a conductive liquid such as water. The velocity is in one direction and displayed on a digital display as feet per second (ft/s) or meters per second (m/s). The device measures water velocity using Fixed Point Averaging (FPA) which is defined as: average velocity measured over a fixed period of time (CFS uses a 30 second interval). At each site the depth of the velocity measurement varies depending on water depth. For depths less than 2 ft (0.6 m), water velocity is taken at 60% of depth (measured from water's surface). For depths greater than 2.0 ft (0.6 m), water velocity is taken at 20% and 60% of depth and averaged.

Flow Transects

Specific sites will be selected to perform flow transect measurements to determine localized river discharge. Site selection is based on the open channel profiling handbook (provided as part of flow meter manual). A rope or cable will be secured to the opposing banks perpendicular to the flow approximately 1 – 2 ft (0.3 – 0.6 m) above the water surface. The rope or cable will be pulled taught using a come-along or similar mechanical device. A measuring tape will be attached to the rope or cable using large binder clips at regular intervals (Figure 3). If the channels are too deep to wade, a small boat will be used. Water velocity and depth are measured at 1.6 ft (0.5 m) stations across the entire channel using a flow meter.

Figure 3. Technician attaching measuring tape to rope using binder clips in Merced River (left) and detail on attaching rope to measuring tape (right).

Discharge (Q) is then calculated using the following formula:

$$Q = \sum (V*D*W \text{ at each station})$$

where, V= average velocity, D=depth, W=width of station

Groundwater Levels

Groundwater wells are located at four points within the MRR, and two wells will be monitored so river stage and discharge can be related to relative changes in groundwater levels and water surface elevations. Information on groundwater will be included in the analyses on vegetation and other biological parameters to investigate the relationship between sub-surface water conditions and various biological responses.

Bathymetry and Topography

Depth Sounder and Total Station

Surveys will be made with a Trimble 4000 GPS receiver, Leica T-1600 theodolite, DI-1600 electronic distance meter, and NA-2002 electronic level to record thousands of individual reference points (i.e., latitude, longitude, elevation). Point spacing will be based on grade-breaks and channel topography instead of a uniform grid (Brasington et al. 2000). Bathymetric surveys will be conducted using traditional survey methods augmented by a fish-finding sonar/mapping GPS unit (Lowrance LMS-520C DF). The unit is mounted on a boat and powered by a 12-v marine battery. Location and water depth are recorded every second and stored electronically. Data are recorded using WGS-84 datum. The marriage of the survey and sonar/GPS data is achieved by recording like waypoints in the sonar/GPS unit and survey equipment. The depth data recorded by the sonar unit is then subtracted from the water surface elevation determined by the traditional survey method. Sediment budgets determine the relative channel stability and thus are a way of evaluating physical habitat change (Merz et al. 2006). To determine bed movement, volumetric assessment will be calculated over time.

Cross-section and Longitudinal Profile Surveys

A series of five cross-sections will be established in the project site and surveyed annually to document changes due to restoration activities along the extent. Cross-sections will also be used to evaluate if constructed floodplain elevations provide: 1) the desired elevations from groundwater (this will be evaluated in conjunction with groundwater monitoring), and 2) floodplain and secondary channel inundation depths suitable for juvenile Chinook salmon. The surveys of these cross-sections will occur concurrently with topographic/bathymetric work when feasible.

Water Quality

Water quality and temperature monitoring will be used to track water quality conditions and groundwater/river interactions. Ongoing temperature monitoring by CDFG and Merced ID, general water quality monitoring by USGS (2002), and recent data collected as a part of the MRR mercury assessment (Stillwater Sciences 2004c) suggest that water temperatures and basic water quality in the DTR are not currently impaired or detrimental to Chinook salmon life stages (Stillwater Sciences 2006). Restoration objectives focus on achieving water quality conditions that support rearing and spawning of Chinook salmon. By tracking the water temperatures, non-advantageous changes will also be detected. Specifically, providing a good understanding of the habitat conditions to ensure targets are met, and higher temperatures than expected do not lead to improvements in habitat conditions for non-native species.

Water Temperature

Continuously recording data loggers (TidBit™; Onset Computer, Inc.) for temperature will be installed throughout the main channel, side channels, and floodplain to verify that the restored habitats maintain acceptable water temperatures during salmonid spawning, incubation, and rearing life stages. Thermographs will be installed during pre- and post-project monitoring work to track the temperature conditions both before and after construction activities at control and impact sites. Thermographs throughout the main channel will evaluate temperature differences in varying habitats within the MRR. Thermographs will be installed and downloaded according to the manufacturer's specifications.

Dissolved Oxygen

During seasonal field trips, dissolved oxygen data will be collected from each sampling location using an YSI Handheld Dissolved Oxygen (DO) Instrument (YSI; Model 550A). These spot measures are designed to determine if minimum criteria for water quality are met, and to meet effectiveness monitoring objectives by determining if performance criteria for DO are met.

Turbidity

During seasonal field trips, instantaneous turbidity will be measured in Nephelometric Turbidity Units (NTU) using a turbidity meter (LaMott Company; Model 2020). These spot measures are also designed to determine if minimum water quality criteria are met, and to meet effectiveness monitoring program guidelines.

Sediment Characteristics

The project objectives include developing an understanding of rates of scour and deposition while restoring ecological processes. Composition and dynamics of channel sediments must be understood to address these objectives. A variety of methods will be used to measure sediment characteristics and mobility. Data will be collected on permeability, surface composition, and sediment composition at depth. The following details the methods used.

Permeability

Before and after project implementation permeability measures will be taken from the sampling sites and replicated over time. Measurements will be taken using a stainless steel permeability standpipe, such as the modified Terhune Mark VI (Barnard and McBain 1994) (Figure 4). Inter-gravel permeability are taken along a transect, and will be measured at three replicate locations at each sampling site. Permeability measurements taken at sites outside the restored reach were monitored for permeability in 2004 and 2005 to compare gravel permeability of the restored and un-restored reaches (Stillwater Sciences 2006), and will be used to make comparisons with these data. At each depth a hollow rod attached to hand powered vacuum pump is lowered into the standpipe until it reaches a depth of 1 in (2.5 cm) below the water surface inside the pipe. The water is evacuated from the standpipe for a fixed time interval (typically ~20 seconds). The captured water volume and pumping time are used to calculate intergravel permeability and a water sample is retained to measure turbidity in NTU using a Lamott 2020 turbidimeter. Intergravel temperature and DO are measured by lowering a YSI (model 550A) probe into the standpipe. At each location, a full suite of water quality measures are taken at three different depths (i.e., 6 in (15.2 cm); 12 in (30.5 cm); and, 18 in (45.7 cm)). In all, data will be collected from eight on-site stations and from one station at each control site.

Figure 4. CFS biologists install a stand pipe (left) and measure intergravel permeability (right).

Channel Bed Surface Composition

To identify conditions of the channel bed surface, pebble counts following methods described in Merz et al. (2004) will occur along longitudinal and/or diagonal sampling transects (Figure 5). Substrate samples are collected by hand every 1.0 ft (0.3 m) along transects, and a round-holed template is used to measure size. A minimum of 50 pieces will be measured per transect and at least three transects will be sampled per site. Substrate will be categorized into 12 size classes: <8.0, 8.0, 16.0, 22.2, 31.8, 44.5, 63.5, 89.0, 127.0, 177.8, 254.0 and >254 mm. Categories are determined by the largest slot through which an individual pebble cannot pass (Merz et al. 2004). In all, data will be collected from eight on-site stations and from one station at each control site.

Figure 5. CFS biologists conduct pebble counts in the Merced River.

Determining Composition at Depth with Bulk Sampling

McNeil Core Sampler

Composition at depth will be determined using a McNeil Core sampler (McNeil and Ahnell 1964) to sample substrate size distributions. Four cores per year will be collected, along with two cores from side channel and floodplain. A McNeil core sampler (Figure 6) is constructed from two different sized cylinders, with the smaller cylinder functioning as a coring device and the larger upper cylinder acting as a collection basin preventing contamination of the sampled water column with outside water and sediment. Sample sites are chosen at random and core depth varies depending on substrate size. Site selection is limited to water depths that do not overtop the sampler, and special care is taken to minimize impacts during spawning and incubation periods. Bulk material is excavated and placed into buckets. Water containing suspended sediment is captured by placing a plug in the bottom of sampler and pouring contents into buckets. Samples are labeled and returned to the lab for analysis. In the lab, samples are dehydrated, sorted by size class and weighed to determine percent composition. Sometimes, larger materials (typically 0.3 in [0.8 cm] – 10 in [25.4 cm]) are separated and weighed in the field while smaller size classes are returned to the lab for dehydration and weighing. In all, data will be collected from eight on-site stations and from one station at each control site.

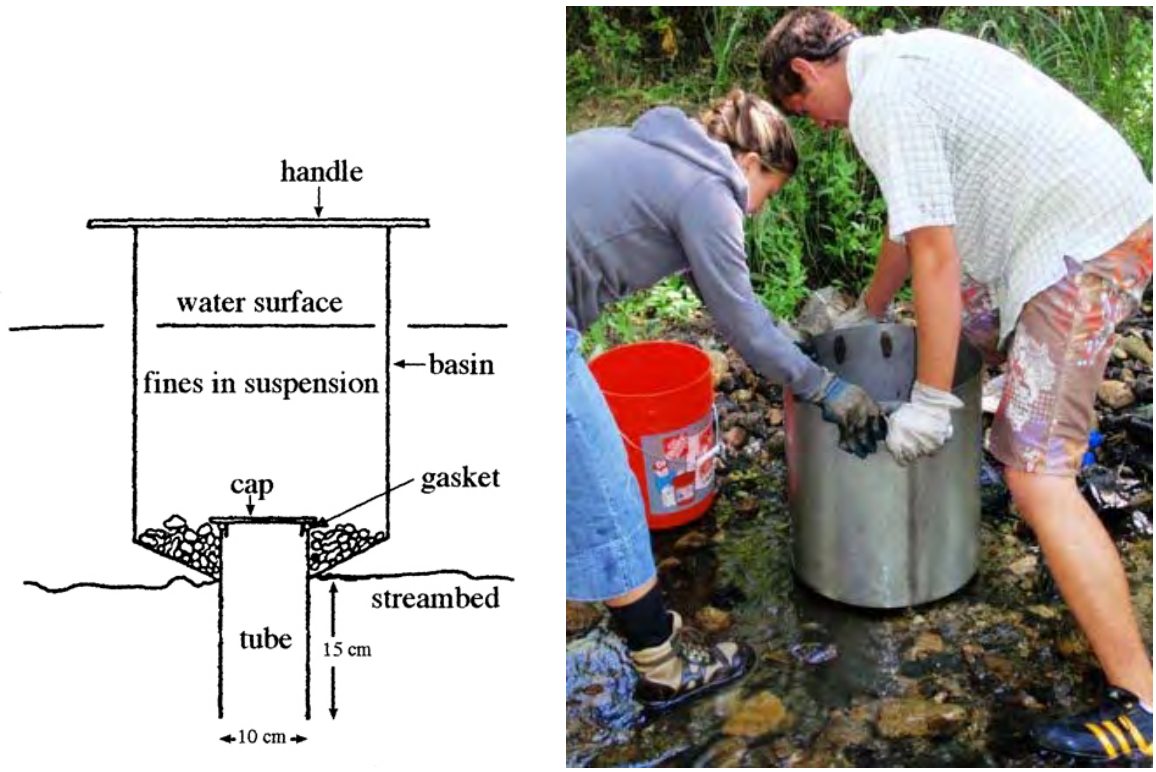

Figure 6. McNeil Core Sampler diagram (left) and the Core sampler in use (right).

Sediment Dynamics

Two methods will be used to assess sediment dynamics, tracer rocks and scour chains. Methods are described below.

Tracer Rocks

Bed mobility, and the frequency and magnitude of sediment transport can be estimated using tracer rocks. Tracer rocks are brightly painted or out-of-basin quartz rocks that can be deployed in the channel and then identified later. Tracer rocks should be placed at, or near, the top of the riffles to accurately assess movement of placed material. Following bankfull or greater flow events, tracer rocks will be monitored to determine if the flow event caused: 1) minor bed surface mobilization, indicative of a flow close to the entrainment threshold for tracer movement (i.e., movement of some tracers, and a high tracer recovery ratio); and 2) more extensive surface mobilization in which nearly all tracers moved significant distances (burial leads to a lower tracer recovery ratio) (Stillwater Sciences 2006). Special care to minimize impact during spawning and incubation periods is always observed. Cores may be removed from the native gravel using a McNeil sampler and the void replaced with painted tracer rocks. Tracer materials should be of similar size composition as the surrounding gravel population. Tracer rock piles and/or cores should be marked with GPS. As scour occurs material is swept downstream. Mobilized tracer rocks are identified using snorkel survey or underwater video camera and their position marked using GPS. Mobilization distances and rates can be determined and extrapolated to account for gravel mobilization of the site; these results will inform sediment budgets, maintenance and injection schedules, and long-term management plans.

Scour Chains

Scour devices (scour chains or scour beads) are mechanisms implanted in streambeds to measure scour and fill of sediment over a period of time (Figure 7). These devices are constructed from lengths of chain, or wire with beads connected to a steel head that is driven vertically into the substrate. During scour and fill events the exposed portion of the scour device lays over to the depth of scour, as flow is reduced sediment buries the scour device. The portion of the chain now parallel to the streambed records the depth of the scour (Figure 8). Scour devices will be placed in transects through the project area and in the control areas. Locations will be recorded with GPS or survey equipment during the topographic/bathymetric surveys. Devices will be monitored on a regular basis typically following flow events or on a seasonal basis.

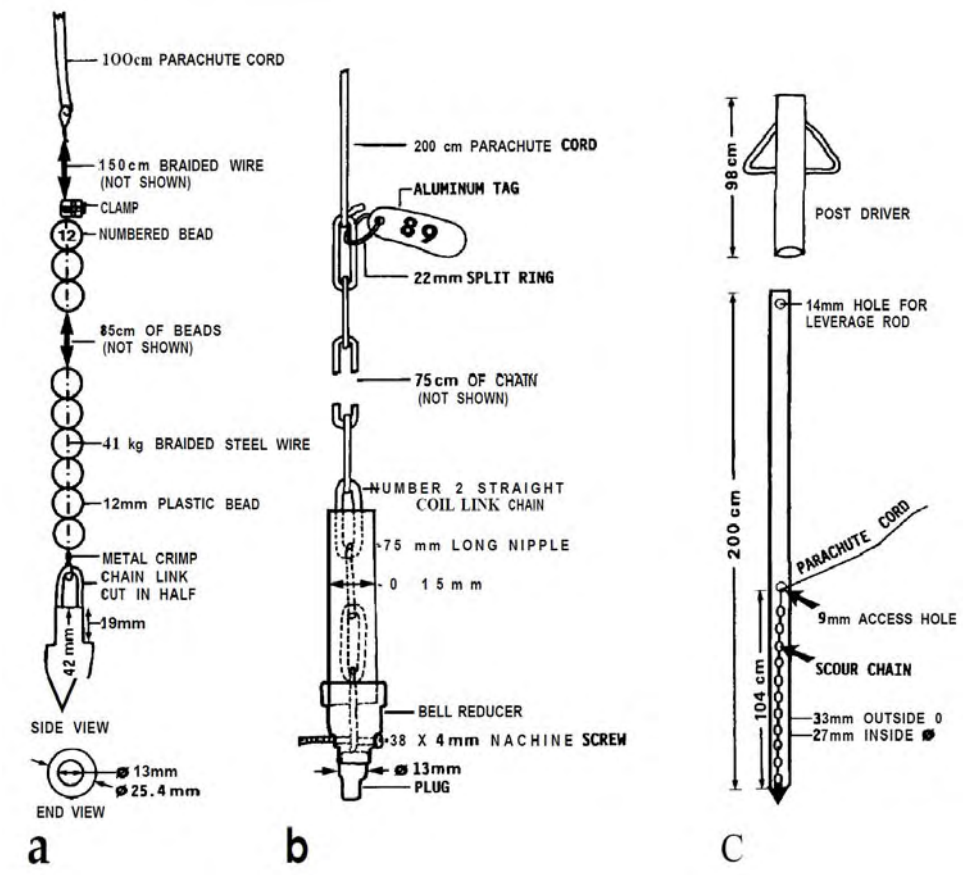

Figure 7. Scour device configurations (Nawa and Frissell 1993).

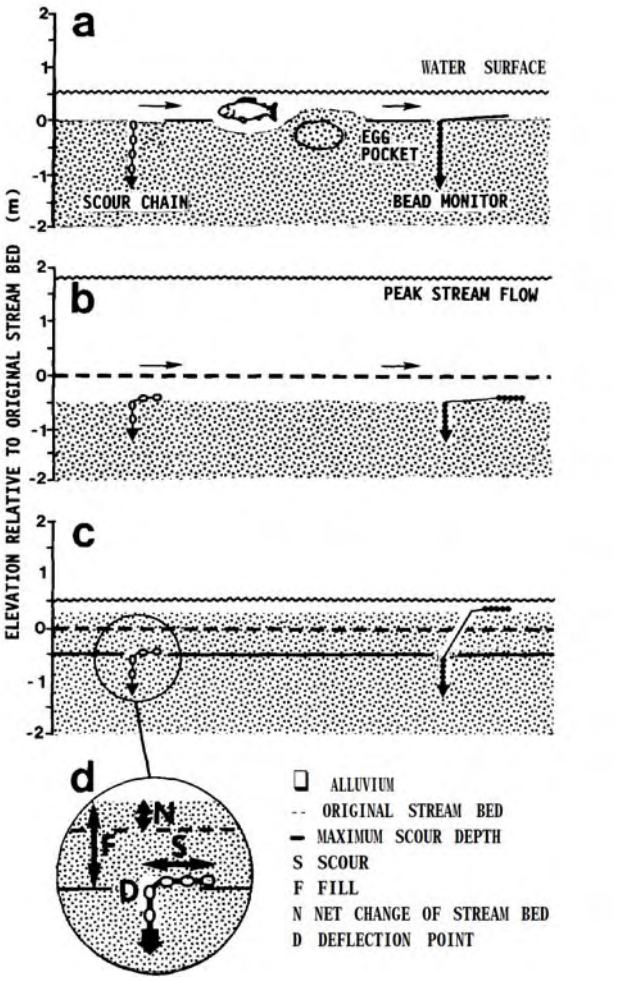

Figure 8. Scour device function (Nawa and Frissell 1993)

Biological Conditions

Repeated field surveys will be conducted to determine if the restoration actions created suitable habitat for target species, and to compare pre- and post-restoration conditions. Surveys of biological conditions will include photo points, vegetation surveys, floodplain soil characteristics, and fish and wildlife surveys.

Photo Points

All photographs will be taken at the same height and in the four cardinal directions (i.e., North, South, East and West) at each sampling site. Photos will be labeled and stored as part of the ArcGIS spatial database developed during monitoring activities. Qualitative conditions can be compared using the photo series and change due to restoration activities can be documented.

Photo points will be established among the sampling sites, and periodic imagery will be collected throughout the project duration for a qualitative measure of habitat structural changes. Each vegetation plot will also have specific photo points associated with them. Monitoring will also include detailed mapping of the extent and geomorphology of side channels, floodplain, and

river mainstem. Additionally, outreach coordination with other groups (e.g., Audubon Society) will provide information on use by non-target species (e.g., birds). All information will be spatially explicit (when information is available) and summarized in a spatial database (i.e., ArcGIS).

Vegetation Characteristics

We will use two primary vegetation monitoring methods for all levels of monitoring and to test project hypotheses about the success of natural recruitment following restoration activities. To improve the probability of detecting changes in vegetation patterns due to project implementation, a stratified-random sampling approach will be applied to vegetation data collection. We will place permanent plots at an upstream control site, at the project site and at a downstream impact site, stratified across the floodplain based on current vegetation structure and distance from the active channel modeled flood recurrence interval. Measures of vegetation composition, dominance and structure over time will be correlated with measures of sediment distribution, hydrology and topography to document project effects and suggest causal mechanisms.

Project Area Vegetation Mapping

The delineation and labeling of vegetation within the project area will be utilized for project planning, implementation monitoring and effectiveness monitoring. Because current aerial photographs of the project area are not available, land cover will be mapped using natural color 1 meter resolution Digital Orthophoto Quarter Quad (National Agricultural Imagery Program 2005). Delineations will be done on-screen at 1:3000 scale with a minimum mapping unit of 0.62 acre (0.25 ha) (Vaghti 2003). Pre-project mapping will primarily delineate existing vegetation to assist with the field sampling effort and overall project planning.

To assess whether retained vegetation followed design plans, post-project satellite imagery will be compared to the pre-project land cover delineations and design plans. If imagery is not available then a subset of retained vegetation patches, representing a minimum of 10% of total retained vegetation area, will be randomly selected from the design plan. These patches will be located in the field and their boundaries recorded and compared to the design plans.

To address questions of river shading, vegetation encroachment into the active channel, cover of non-native woody species, and connectivity of woody vegetation across the project area vegetation mapping will be repeated after 2 years. Field collected data will be used to further refine the delineations and map labels.

Field-Collected Vegetation Data

A BACI study design (Eberhardt 1976) will be used to improve the probability of detecting changes in vegetation patterns due to the project restoration actions. See Figure 2 for a simplified schematic of the field sampling design, including an upstream control site and a downstream impact site. Using GIS, the project area will be stratified by existing land cover (see vegetation mapping above), modeled flood recurrence interval (1-5 yr, 5 yr, 10 yr, 100 yr), topographic restoration, and active vegetation restoration then overlaid to produce a series of polygons.. Within each stratification, a subset of polygons will be randomly selected for sampling. The project areas subjected to topographic and active vegetation restoration will be sampled more intensively, both spatially and temporally, than the remainder of the site. Specifically, if the total planted area is less than 12.14 hectares (30 acres) then 2% will be

sampled; if the total planted area is greater than 12.14 hectares then 1% will be sampled (Harris et al. 2005).

All sampling sites will be surveyed to provide GPS coordinates, and annual monitoring will occur in the early summer (or peak season for herbaceous flowering plants) will occur. The number of plots will provide adequate sample sizes necessary to provide robust data for statistical tests and comparisons. Plant response in the BACI context will be tracked at a sub-set of sampling locations, and composition, distribution, and recruitment will be assessed with other environmental variables (e.g., groundwater levels, inundation frequency, etc.). A 400 m^2 (20 m x 20 m) sampling plot, the standard for riparian shrub and tree vegetation (CNPS 2007), will be centrally located within each polygon selected for sampling. The following protocol will be applied to the project area, upstream control, and downstream impact sites. All plots will be marked with GPS locations, photographs, and detailed on-the-ground mapping and descriptions. Vegetation and substrate sampling will follow the California Native Plant Society Relevé Protocol (CNPS 2007).

To address questions of recruitment, native and non-native cover and vegetation community organization data listed in Table 7.I, 7.II and 7.III will be collected for all plots following the CNPS relevé protocol.

Table 6. Field collected vegetation data.

DATA TYPE	CLASS	SUBCLASS	EXTENT
I. Vegetation. Complete composition by stratum will be identified and cover visually estimated.	Tree		
	Shrub		
	Herb		
	Seedling		
	Sapling		
	Non-vascular		
II. Surface. The percent cover of each surface will be visually estimated.	Basal area of stems		
	Bedrock		
	Litter		
	Water		
	Soil/rock:		
		Fines	<0.2 cm
		Gravel	0.2-7.5 cm
		Cobble	7.5-25 cm
		Stone	25-60 cm
		Boulder	>60 cm
III. Recruitment. Mapping and diameter of all woody seedlings within subplots.	Species		
	Stem diameter	<1.0 cm	< 1.0 cm
		1.0 -10.0 cm	Actual diameter

Wildlife Surveys

Wildlife surveys will occur with qualified personnel following guidelines outlined by USFWS and CDFG (http://www.dfg.ca.gov/wildlife/nongame/survey_monitor.html). There are survey protocols for specific listed species. Surveyors will sample the project area to look for signs of

residence or breeding in the area. Nests of listed species will be flagged and the location recorded; flagging will also establish buffer following recommendations of CDFG.

Fish Surveys

Snorkel Surveys

Snorkel surveys will be conducted to assess juvenile and adult use of the restored sites. Snorkeling methods will be consistent with other studies (Edmundson et al 1968; Hankin and Reeves 1988; McCain 1992; Jackson 1992; Dolloff et al. 1996; Cavallo et al. 2003). Sample units will be snorkeled by two or three divers moving upstream adjacent to each other for margin habitats and downstream for mid-channel habitats. Fish will be observed, identified and counted by size group as divers proceeded up or down the sampling unit. Counts will be compiled for all divers and recorded as a total for each sample unit. Fish will be categorized by species and size classes (0 – 50 mm, 51 – 80 mm, 81 – 100 mm, 101 – 120 mm, 121 – 150 mm, 151 – 200 mm, 201 – 300 mm, and >301 mm). In addition to the above categorizations, additional mesohabitat quality metrics were assessed. Habitat characterizations include qualitative assessments of: river margins; cover habitat; and predominant substrate types.

Survey timing will coincide with rearing, migration and/or spawning timing of the fish species of interest. Stream flow conditions must also be considered prior to conducting a survey for safety precautions. All surveys will be lead by a dive master with training and experience conducting snorkel surveys. Snorkel surveys are most often conducted using teams moving through a survey area in a concerted manner to ensure complete coverage. Generally teams spread laterally across a channel with dispersion based on underwater visibility. Teams should move at the same rate in parallel lanes to prevent double counting fish. Movement most often occurs in the upstream direction to: 1) prevent turbidly from obscuring observations; and, 2) maximize fish observations because fish most often orient facing upstream. To help minimize disturbing fish, surveyors attempt to limit fast or sudden movements and wear mud-brown colored StreamCount drysuits (O.S. Systems, Inc.). Dive slates will be used to record fish species, size categories and other observations.

All surveyors will be proficient in the identification of fish present in the Merced River region (McConnell and Snyder 1972). Daytime surveys generally occur when water temperatures range between 10°C and 18°C. Daytime water visibility is generally the best between late morning and early afternoon, and cloudy or overcast days are preferred over clear sunny days to reduce the effects of shadows on the water. Nighttime surveys are preferred when water temperatures are below 10°C or above 18°C. To gather presence/absence data and baseline habitat use, only a one-pass approach is needed.

River margins will be classified according to position in the channel (i.e., left, middle, or right) and margin type (i.e., bar, bank or main channel). Bar margins are generally shallow with a gradual slope and typically limited vegetation due to scour and regular inundation during high flow events. Bank margins are generally deeper with steep eroding banks and more extensive vegetation; these margins often occur opposite of bar areas against bluffs and levees where high flow induces greater erosion and scour. Main channel areas are away from bars and banks in the middle of the channel where velocities and depths are greater. Cover habitat will be broken down into three qualitative classes (i.e., type, size, and quality). Cover types include instream, overhead, both, or flooded terrestrial and aquatic vegetation and will be further defined by size categories of less than 15 cm, 15 – 30 cm, and greater than 30 cm. Cover quality will be defined

as a combination of the percent of surveyed habitat affected by the cover and the degree to which fish depend on the cover. Dominant and sub-dominant substrate types will be defined by organic matter/silt, sand, gravel, cobble, boulder, bedrock, and rip-rap.

Back Pack Electrofishing

Sampling sites may be sampled using standard electrofishing methods. Cramer Fish Sciences uses a Smith-Root, Inc. Model 12B back pack electrofisher (BPS). All BPS operators and crew are trained in BPS operation according to NOAA NMFS Guidelines for Electrofishing Waters Containing Salmonids Listed under the Endangered Species Act (2000). Equipment will be inspected prior to every field use for serviceability to protect fish and ensure safety. Water temperature and conductivity will be measured and recorded prior to every electrofishing survey. No electrofishing will occur when water temperatures reach or exceed 65°F (18.3°C), or when conductivity exceeds 350 μS/cm. Initial BPS settings will be set to NOAA recommended initial settings (100 volts, 500 microseconds pulse width, and a 30 Hertz pulse rate). When needed, settings will be gradually increased to a minimum level necessary to capture fish. Direct current will always be used and settings will never exceed max allowable settings (400 volts, 5 millisecond pulse width, and a 70 Hertz pulse rate). A minimum of one assistant will aid in netting stunned fish and other aquatic vertebrates. Collected fishes will be processed following CFS standard protocol (Gray et al. 2009)

Spawner Surveys

Information on adult spawning will be provided by ongoing CDFG surveys in the Merced River and with additional coordinated surveys by CFS. The CDFG conducts annual escapement surveys in the Merced River, and provides information on abundance and distribution of spawning fall-run Chinook salmon. The CFS team will also conduct redd and spawner surveys in coordination with CDFG. These data will be used to provide for accurate mapping of spawning and redd locations at the sampling sites, and documenting change over time. This information is critical to addressing project hypotheses regarding the productivity of the restored habitat for spawning salmon. Spawner surveys will continue to be conducted during the fall-run Chinook salmon spawning season (mid-October to January) up to every other week. These data (and other information as necessary) will be used to calculate redd densities per riffle in the restored channel and document trends in redd densities over time. Latitude and longitude will be collected for individual Chinook salmon redds, and a total count will be summed for each sample date. Coordinates for individual redds will be used to display the spatial extent of spawning at the site for each sample date.

Determining Diet Composition with Gastric Lavage

Following methods described in Haley (1998) and Koehler et al. (2006), stomach contents of juvenile Chinook salmon will be obtained by gastric lavage. Captured fish will be anesthetized with MS-222 (tricaine methanesulfonate). The fish will be weighed to the nearest 0.01 g and measured to the nearest 1 mm FL. For small fish (>50 mm) a small syringe fitted with a 3-mm diameter rubber tube will be put into the fish's esophagus. The syringe will be used to gently emptied the stomach contents from the fish into a 106 µm sieve, and the fish will be returned to freshwater to recover. The stomach contents are then washed into a Ziploc™ or Whirlpac™ plastic bag and preserved with 70% ethanol. Organisms in the stomach contents will be examined and identified with a light dissecting microscope to the smallest taxonomic resolution

reasonable (usually species, but in some cases to the family level). Each prey category will be enumerated and literature weights will be used to estimate volume.

Macroinvertebrates

Macroinvertebrate communities will be monitored to determine the composition and abundance of various species. Invertebrate sampling will occur in replication at each sampling site with samples collected in the spring and summer. Samples will be collected with a 330 mm i.d. X 400 mm high, stainless steel 368 µm nitex Hess Stream Sampler (bottom area opening = 0.086 m^2) with an attached 368 µm dolphin bucket (Figure 9). The Hess sampler design isolates the sample area, hinders contamination from drift and provides consistency in area/volume sampled and invertebrate size. Samples are taken to a depth of approximately 0.5 ft (15 cm) within the substrate. Drift insects will also be collected using a drift sampler with 106 µm mesh pulled for 32.8 ft (10 m) across the water's surface. Collected samples are rinsed into 500 mL labeled bottles with 70-95% ethanol. Samples will be transported to the laboratory and sorted under a light dissecting scope (e.g., 60X). Taxa will be identified to species as possible; size classes and life stage will be recorded. Individual organisms were grouped by type, further categorized by individual size classes (<2, 2 – 7 mm, 8 – 13 mm, 14 – 20 mm, and > 20 mm) and life stages (larva/nymph, pupa and adult), and enumerated for each type-size-life stage combination. Organisms will be grouped into functional feeding categories following Merritt and Cummins (1996), Wiggins (1998), and Pennack (1989).

Figure 9. Biologists using Hess Sampler to collect benthic macroinvertebrates in the Merced River.

Validation Experiments

Egg-to-Fry Survival

The focus of this validation experiment is to measure the survival and growth of Chinook salmon embryos in the restored and unrestored reaches of the MRR. Egg incubation tubes will be buried at the various sampling sites to test survival and growth of fertilized eggs. Egg tubes will be constructed of modified 35-polyvinyl chloride (PVC) with two caps to close the ends (Figure

10). Evenly spaced holes will be drilled in the tubes, and the inner surface covered with 0.14 in (0.35 mm) plastic mesh screen following methods described in Leitritz and Lewis (1980) and Merz et al. (2004). At each site, an artificial redd will be constructed and egg tubes will be buried horizontally and perpendicular to stream flow at these sites. Tubes will be buried to a depth of 0.87 in (22 cm), the approximate depth of redd pockets as reported by Healey (1991) and Montgomery et al. (1999). Tubes will stay in the gravel for 4 – 6 weeks, and all organisms will be recovered and survival and growth will be determined in the field. A one-way *t* test will be used to compare the survival and growth of embryos from the restored and unrestored sites.

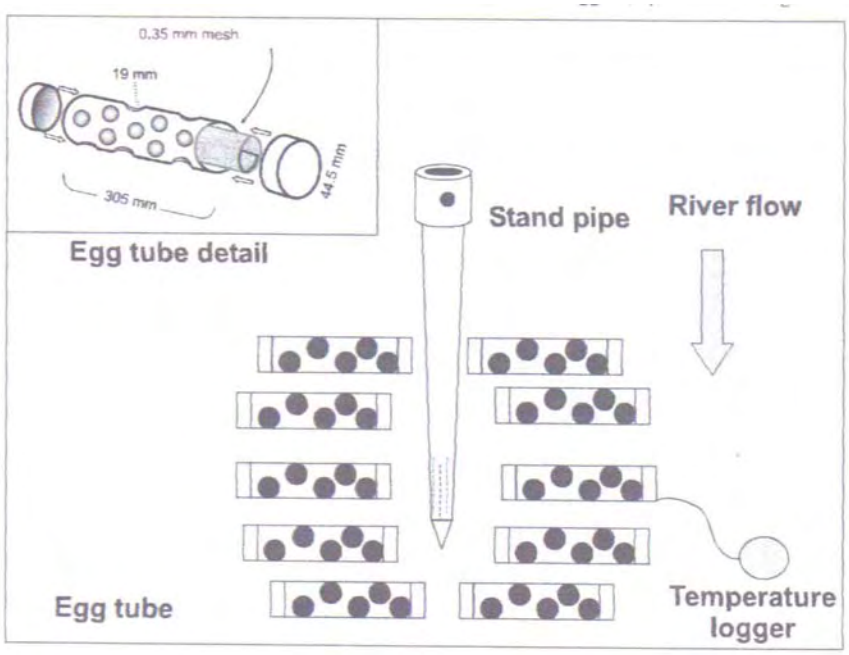

Figure 10. Diagram of egg tube construction and deployment in relation to river flow, temperature logger and permeability measures (from Merz et al. 2004).

Juvenile Growth Potential Model

To investigate the function of juvenile habitat provided as a result of this restoration project, we will evaluate the change in habitat in terms of modeled growth potential for juvenile salmonids.

Alternative Methods for Obtaining Bioenergetics Model Data

The key parameters to run the bioenergetics model are: temperature, consumption rate, diet composition, prey quality, and fish size. Detailed temperature data will be collected as part of the effectiveness monitoring program. Information on prey quality will use established literature values unless funds support laboratory analysis on energy content. Data on consumption rate and diet composition can be obtained with a variety of methods, considering the proper assumptions.

Method 1: Up to four large enclosure nets (i.e., 10 X 20 ft and X 0.25" mesh size) will be established in various restored-reference habitat types (as allowable by river conditions). Up to 100 juvenile Chinook salmon will be held in the enclosure nets for 16-24 hours. Diet contents of fish will be determined from samples (n=10-20) collected every eight hours following standard procedures of gastric lavage (see previous description). After 24 hours, any remaining fish will

be sampled for stomach contents. Diet information will then be compiled to determine overall diet composition for that habitat type and time of year.

Method 2: Diet information may also be obtained through the fish surveys at the project and control sites. Beach seining or electrofishing may allow low impact capture of juvenile Chinook salmon that could be sampled for diet contents using gastric lavage. Information on consumption rate will have to be based on stomach fullness. This method assumes the fish have been feeding for the past several hours in the area collected. This method has additional limitations in feasibility due to the very low numbers of wild fish and the inability to collect a suitable sample size.

Method 3: If Methods 1 and 2 are not available, diet information for the local area of the Merced River may be obtained through sampling juvenile Chinook salmon (by gastric lavage) at the RST monitoring operations at Hopeton, CA. A sub-sample of juvenile Chinook salmon (up to 10) could be collected during the out-migration. Diet composition information could be collected for early and late out-migrants. Assumptions would include that the fish collected in the RST operations have diets representative of those feeding in the project reach. [This method would be less suitable for depicting the diets of fish feeding on the restoration floodplain, post-project.]

Information from any of the above methods would be used with the "Wisconsin" computer model (Hanson et al. 1997) to simulate fish growth in response to changes in body mass, diet composition, and temperature. Results obtained from these experiments will provide a *relative* measure of potential growth at the various sites.

Data Analysis and Evaluation

Statistical analyses will be performed with several programs (i.e., S+, R, JMP, Origin, PRIMER, and Excel). Multivariate statistics will be used along with linear and multiple regressions to relate various results to explanatory variables, such as vegetation recruitment success, spawner distribution and abundance, fish use and growth potential to physical conditions. There are a variety of statistical tools available to analyze data from non-replicated BACI studies (Miao et al. 2009). As the sampling framework is finalized, these tools will be researched further and described herein.

Permitting

All of the activities in this monitoring program will only occur once all the permissions and permits have been obtained. The property is owned by CDFG and all permissions to obtain property access have been achieved. Control sites exist on property owned by MID and Santa Fe Aggregates. Coordination with these landowners has allowed us to access these sampling sites. All field personnel will have a Scientific Collecting Permit (SCP) with a current amendment letter describing all methods and activities. This document provides additional detailed information on methods and sampling design to CDFG. A federal 4(d) permit is required when working in areas with steelhead which has been renewed for 2010. All safety and fish handling precautions will be followed.

Gear List and Planning

The following supplies and equipment will be needed to complete the described monitoring activities:

Onset U20 Transducer (13)

Solinist Water Level Meter (1)

Disposable Bailer (1)

Stand pipe (2) and Other Supplies

Multi-Parameter YSI 600XLM and accessories (1)

HOBO Water Temp Pro v2 (12)

HOBO Waterproof Shuttle (2)

HOBOWare for Windows (1)

NIST Certified Thermometer (1)

Hach 2100P turbidimeter and accessories (1)

Invertebrate sampling supplies

Fish use survey supplies

Wildlife survey supplies

Ohaus® Scout Pro Electronic Balance, 600g x 0.01g

Ohaus® Adventurer™ Pro Electronic Balance, 51g x 0.001g

Dissecting Scope

Fiber optic lights

Enclosure nets

Egg tube supplies

Sample fish and embryos (if available)

The following provides a draft sampling schedule with objectives (Table 7) and survey frequency, staff and duration and deliverables (Table 8).

Table 7. Field sampling schedule and project timeline.

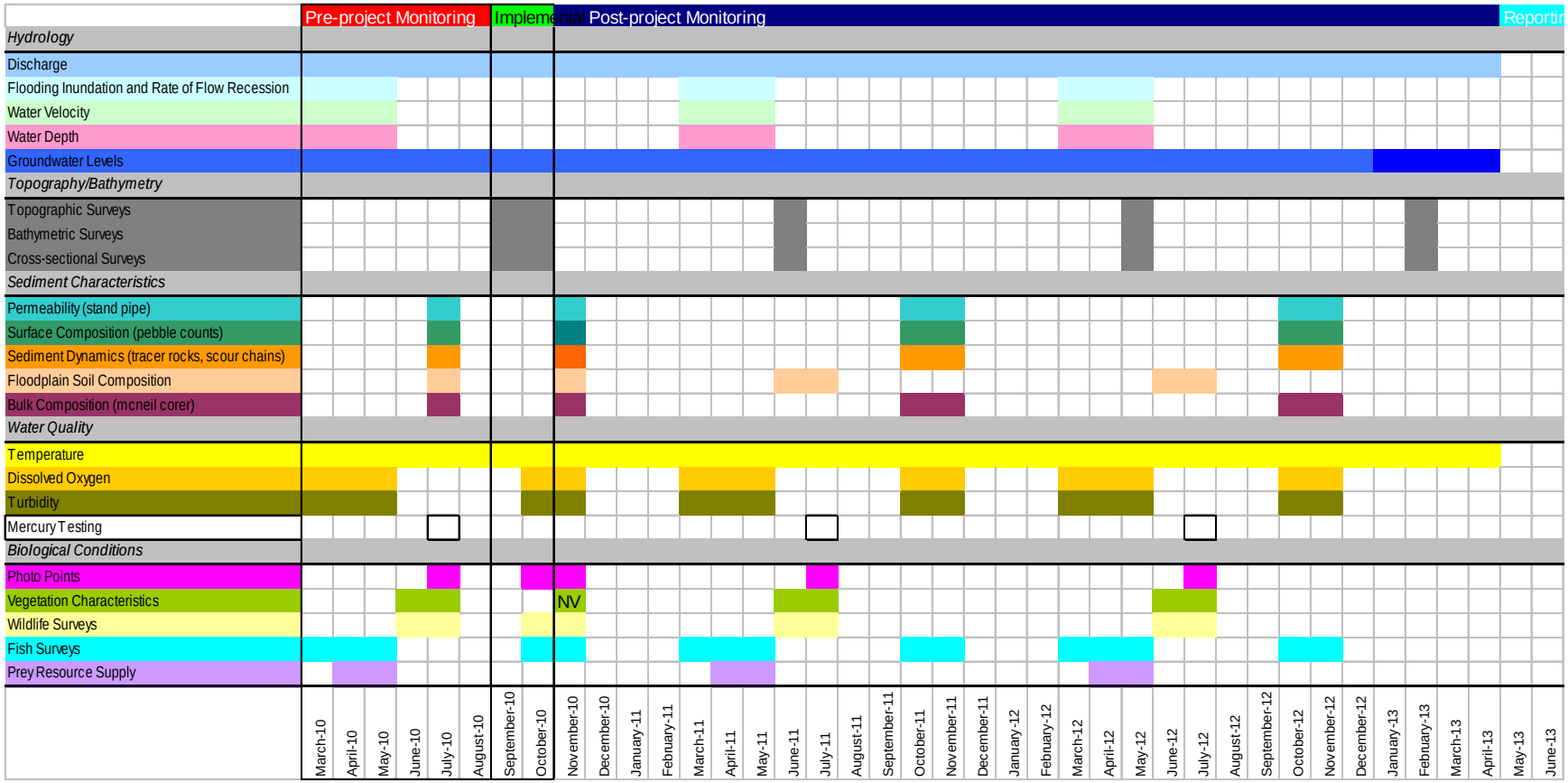

Table 8. MRR summarized monitoring activities and deliverables.

Activity	Survey Frequency	Survey Time and Duration	Personnel	Deliverables
Hydrology	Continuously	Continuously	MID and data loggers	-data -summarized data
Topography/Bathymetry	Annually	3 field days in January	2 Technicians to accompany PWA	-Digital elevation models (dems) -Raw XYZ data
Water Quality, Sediment Characteristics and Dynamics,	Bi-annually	4 field days in Spring/Fall	3 Field Technicians and Biologist	-Data -Summarized data and graphs
Biological Monitoring I: Photo Points, Fish and Wildlife Surveys and Prey Resource Sampling	Bi-annually	4 field days in Spring/Fall	3 Field Technicians and Biologist	-Data -Summarized data and graphs -Voucher specimens (invertebrates/diets)
Biological Monitoring II: Vegetation Surveys	Annually	5 field days in May or June	1 Field Technician and Plant Ecologist	-data -summarized data and graphs -summary report
Enclosure Experiments	Annually	4 field days in the spring (as dictated by flow regime)	3 Field Technicians and Biologist	-data -summarized data and graphs
Egg-to-Fry Survival	Annually	4 field days (2 for placement; 2 for egg tube recovery) in the fall	3 Field Technicians and Biologist	-data -summarized data and graphs
Native Vegetation Recruitment	Annually	5 field days in May or June	1 Field Technician and Plant Ecologist	-data -summarized data and graphs

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	Mitigation Measure	Implementation Schedule	Responsible Party	Status / Date / Initials
1	Native trees, such as Fremont cottonwood Populus fremontii, oak Quercus spp., and willow Salix spp. with a diameter-at-breast-height (DBH) of 6 in (15.2 cm) or greater will be protected with 30-ft (9.1-m), 10-ft (3-m), and 10-ft (3-m) buffers, respectively. Native trees will be marked with flagging and fenced if close to project work area to prevent disturbance. To compensate for the removal of riparian shrubs and trees during project implementation, the plans would identify tree and shrub species that would be planted, how, where, and when they would be planted, and measures to be taken to ensure a minimum performance criteria of 70% survival of planted trees for a period of three consecutive years. Irrigation will not be used, but the return of inundation to the floodplain is expected to promote growth of native riparian species. If the 70% survival criteria are not met, more native trees will be planted and irrigation will be evaluated. The tree plantings would be based on native tree species compensated for in the following manner: • Oaks having a DBH of 3 – 5 in (7.6 – 12.7 cm) would be replaced in-kind, at a ratio of 3:1, and planted during the winter dormancy period in the nearest suitable location to the area where they were removed. Oaks with a DBH of greater than five inches would be replaced in-kind at a ratio of 5:1. • Riparian trees (i.e., willow, cottonwood, poplar, alder, ash, etc.) and shrubs would be replaced in-kind and on site, at a ratio of 3:1, and planted in the nearest suitable location to the area where they were removed.	Entire Project	Permittee	
2	Following methods in the Stillwater Sciences (2004) Mercury Assessment, total mercury from sediments will be evaluated to insure samples are below or within the range of natural background levels (50–80 ng/g) for California's Central Valley (Bouse et al. 1996). All samples previously collected were below this level (Stillwater Sciences 2004). Aqueous raw total mercury was also found to be below the California Toxics Rule for a drinking water source of 50 ng/L. In-river channel aqueous raw total mercury was at or below levels measured at relative control sites for the Cache Creek watershed (Slotton et al. 2004), a highly mining-impacted watershed in Northern California which has been identified for regulatory and remedial action with regard to mercury (Stillwater Sciences 2004). It is unlikely that excavation and regrading activities may uncover mercury hot spots and or mobilize mercury in the aquatic food web; however, if samples are found with mercury levels above established standards, work will be halted to assess contamination potential. As a further precaution, mercury levels will be measured before, during, and after restoration activities in the MRR area.	During Construction	Permittee	

	Mitigation Measure	Implementation Schedule	Responsible Party	Status / Date / Initials
3	To meet CDFG's recommendations for mitigation and protection of Swainson's hawks Buteo swainsoni, surveys will be conducted by a qualified biologist for a ½ mile radius around all project activities. Site surveys will be conducted to identify suitable foraging and roosting habitat and species presence, in accordance with CDFG survey guidelines. The no-disturbance buffer should be a minimum of 0.25 mi (0.40 km) around any identified nests. If State-listed species are found to be nesting in the project area, CDFG will be notified to discuss project implementation and avoidance of take. Note, this project also provides for Swainson's hawk conservation: by restoring the river landscape and ecosystem processes that support riparian forests. Swainson's hawks have strong association with riparian forests which suggests that protection and restoration of these habitats may provide nesting habitat superior to other sources of trees such as roadsides and field margins. Bird species that occupy the mature tree and gallery forest component of riparian systems will also benefit from conservation or restoration of nesting habitat for Swainson's Hawk (Woodbridge 1998).	Entire Project	Permittee	
4	The project will comply with Section 401 of the Clean Water Act and obtain certification for project-related activities to control sediment and maintain water quality downstream of the project site during the construction activities. To minimize risk from additional fine sediments, all trucks and equipment will be cleaned, gravels will be processed away from flowing water, and in-stream work will occur during the low flow season (e.g., < 300 cfs). Sediment fencing will be used along the river corridor to capture floating materials or sediments mobilized during construction activities, and prevent water quality impacts. Stream bank impacts will be isolated and minimized to reduce bank sloughing. The banks will be stabilized with revegetation following project activities.	Entire Project	Permittee	
5	Implement the following dust reduction measures during movement of materials from construction staging area to sites where gravel augmentation will occur to reduce construction-related emissions: □ wet materials to limit visible dust emissions using water; □ provide at least 6 in (15.2 cm) of freeboard space from the top of the container; or, □ cover the container.	During Construction	Permittee/Subcontractors	
6	Implement the following dust reduction measure during gravel placement to reduce construction-related emissions: □ limit or promptly remove any of mud or dirt on construction equipment and vehicles at the end of each workday, or once every 24 hours.	During Construction	Permittee/Subcontractor	
7	Each year, before beginning construction activities a pre-project survey will be conducted of the project site. Extensive surveys for elderberry shrubs have already been completed (URS 2006d), and areas to avoid identified. If elderberry shrubs (or other special status plants) are identified in subsequent surveys they will be avoided. Complete avoidance may be assumed when there is at least a 100-ft (30.5 m) buffer around the plant. These buffers will be established and maintained around all elderberry plants with stems measuring 1 in (2.5 cm) in diameter at the ground level (USFWS 1999). Project activities will be adjusted to ensure no activities occur in the buffer area, thereby avoiding any negative effects on valley elderberry longhorn beetle.	Entire Project	Permittee	

	Mitigation Measure	Implementation Schedule	Responsible Party	Status / Date / Initials
8	Table 5 lists the critical periods when disturbance could result in significant impacts to individuals or populations of special status species. To avoid these impacts, all project ground disturbing activities will be conducted during the period August through September, which is outside the listed critical periods (Table 5 – see EA/IS). If work must be conducted before this time, appropriate surveys would be performed to avoid impacts to special status and sensitive species. Nesting birds and raptors are protected under the MBTA and California Fish and Game Code. Trees and shrubs within the project area likely provide nesting habitat for songbirds and raptors. If tree removal is unavoidable, it will occur during the non-breeding season (mid-September). If other construction activities must occur during the potential breeding season (February through mid-September) surveys for active nests and/or roosts will be conducted by a qualified biologist no more than 30 days prior to the start of construction. A minimum no disturbance buffer will be delineated around active nests (note, size of buffer depends on species encountered) until the breeding season has ended or until a qualified biologist has determined that the birds have fledged and are no longer reliant upon the nest or parental care for survival.	Entire Project	Permittee	
9	For bat species, before any ground disturbing activities, a qualified biologist will survey for the presence of associated habitat types for the bat species of concern. If bats are present, suitable avoidance and conservation measures will be implemented: project will avoid work in May, June, and July and will apply a minimum 300 ft (91.4 m) buffer of roosting bats, maternity roosts or winter hibernacula until all young bats have fledged.	Entire Project	Permittee	
10	Pre-construction surveys will be conducted by qualified wildlife biologists, who will determine the use of the project site by American badgers; surveys will focus on identification of potential badger dens within the construction footprint and a minimum 250 ft (76.2 m) buffer around the construction footprint. If badger dens are located within the construction or buffer area, prior to initiation of construction CDFG will be consulted for further instructions on methods to avoid direct impacts to this species. Pre-construction surveys will also be conducted by qualified wildlife biologists to determine the use of the project site and a minimum 500 ft (152.4 m) buffer around the construction footprint by San Joaquin kit fox; surveys will focus on identification of potential, atypical, active, and natal (USFWS 1999b) kit fox dens. If potential kit fox dens are located within the construction or buffer area, a minimum of five consecutive nights of camera/scent stations and track stations will be placed by the den entrances in order to determine if the den is in use by kit fox. If active or natal dens are confirmed, CDFG and USFWS will be consulted for further instructions on methods to avoid direct impacts to this species as well as the need for incidental take permits.	Entire Project	Permittee	
11	Special transportation routes and work areas will be designated to avoid damaging trees and shrubs in riparian habitats, especially those sensitive species described above. Potential impacts to the riparian vegetation could occur during the transport of gravel from construction staging area to the river. These impacts will be minimized to the greatest extent practicable by selecting routes that avoid or minimize damage. There will be no impacts on heritage size trees (i.e., greater than 16 in [40.6 cm] in diameter). Trees will be flagged and fenced (when near work area) to prevent unintended damage	During Construction	Permittee/Subcontractor	

	Mitigation Measure	Implementation Schedule	Responsible Party	Status / Date / Initials
12	To mitigate noise related impacts, the project will require all contractors to comply with the following conditions: □ restrict construction activities to time periods when there is the least potential for disturbance; □ install and maintain sound-reducing equipment and muffled exhaust on all construction equipment; and, □ optimize the location of processing equipment to be the least disturbance in terms of noise for the local residents.	During Construction	Permittee/Subcontractor	
13	If any objects of cultural significance are unearthed during the construction process, work will be halted until a qualified archeologist can assess the significance of the new find. If human remains are unearthed during the construction process, the project team will comply with the California Health and Safety Code Section 7050.5, which states that no further disturbance shall occur until the County Coroner has investigated the situation following the Public Resource Code Section 5097.98.	During Construction	Permittee	
12	The Designated Biologist shall be on-site daily while construction and/or surface-disturbing activities are taking place to minimize take of the Covered Species, to check for compliance with all mitigation and avoidance measures, to check all exclusion zones to ensure that signs, stakes, and fencing are intact, and that human activities are restricted to outside of these protective zones.	Entire Project	Permittee	